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Advertisement Index, see page xxxvi.

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THE

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Vol. LXXXV.] CONTENTS: November 21, 1919. [No. 2,191.

	Page
An Excellent Start...	641
Light and Relativity	642
The Status of the Engineer	642
Electrical Trade Unions	643
Supply Troubles in Paris	643
Heating Problems	643
Practical Points in the Laying Down of Motors and Switchgear. by J. Walker (*illus.*)	644
That Six Shillings!	646
The Electrical Trades Benevolent Institution	647
Legal...	648
The Institution of Electrical Engineers...	649
Correspondence— The New Standards for Cables.—The Employer, the Staff Engineer, and Labour.—Electric Soldering Iron.—An Octaval Rule	651
The Electricity Supply Bill	652
Business Notes	652
Notes...	657
City Notes	662
Stocks and Shares	663
Market Quotations	664
The University Degree in Engineering: A Uniform Standard Needed, by "A University Lecturer"	665
The International Motor-Car Exhibition (*illus.*) (*continued*) ...	666
Electric Power Supply to Works...	668
Modern Street Lighting (*illus.*)	669
New Electrical Devices, Fittings and Plant (*illus.*)	670
Reviews	671
New Patents Applied for, 1919	672
Abstracts of Published Specifications	672
Contractors' Column ... ... Advertisement page	xxvi

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"ELECTRICAL REVIEW": TIME OF PUBLICATION.

Readers who are receiving their copies of the ELECTRICAL REVIEW a little later than formerly, are reminded that as the result of changes in printing arrangements and in consequence of rapidly increasing circulation, publication recently had to be deferred until Friday afternoon. The REVIEW is now on sale in London at 4 p.m. on Fridays; copies sent by post or obtained through local agents should reach the hands of subscribers on Saturday mornings.

AN EXCELLENT START.

THOSE who, like ourselves, had formed a highly optimistic opinion as to the choice of President of the Institution of Electrical Engineers, and who were present at the reading of his inaugural address, will certainly plume themselves on their sagacity, whilst joining us in congratulations to Mr. Roger Smith. His address was a model of its kind, and dealt with many interesting and important subjects with sympathy, breadth of mind, and that common sense which he so much admires in others, and which in his own case is wholly free from what he describes as its great enemy.

We were particularly pleased that he opened his address with an appropriate reference to those who had served and those who had fallen in the war, and urged employers to give preference to disabled men. We can never discharge our debt to them; let us at least do all that we can to mitigate the loss that they have suffered on our behalf.

Mr. Smith also spoke of the urgent necessity of improving educational methods, and facilitating the upward progress of poor men endowed with brains. To say that all men are born equal is the crudest of fallacies; they are all born different, and it should be our aim to seek out talent and develop it wherever it is found. The subject is intimately bound up with the promotion of scientific research, and in this connection the President, endorsing the views of his predecessor, laid due stress on the grave danger to research that may result from its patronage by Government Departments, tending to strangle it in the bonds of the Civil Service.

Space does not permit of our touching upon all the matters dealt with by the President, and we must pass on at once to his main theme—the electrical engineering of railways, a matter with which he is peculiarly qualified to deal. In the first place, he pointed out that, in view of the enormously important place that electrical engineering will take in railway work in the near future, it is essential to success that the work shall not be regarded as a branch of another department, such as that of mechanical engineering, but shall be dealt with in a department specially created for that purpose. Splendid work has been done by the mechanical engineers of British railways, both at home and abroad; but the electrical work requires a highly-specialised training and long experience in electrical construction, and success can only be attained if it is carried out and operated by the most able men.

Dealing with the problem of electrifying the railways of this country, he made it clear that by far the greatest benefit of such a conversion would be felt in connection with goods traffic, and declared that mineral lines with steep gradients could be electrified with advantage even when electricity was not cheap—the saving in time and labour being the main consideration. Apart from any reduction in actual working cost, the saving of 60 per cent. of the coal used on railways would in itself be an economy of national importance. It is noteworthy that the present cost per train-mile for goods and mineral traffic is more than double that of the passenger service, and the respective margins for economy are in a still greater ratio, so that the former presents much the more favourable case for immediate electrification, particularly where mineral lines are concerned. The only example of heavy electric traction in this country at present is the Newport-Shildon mineral line of the North-Eastern Railway Co., 18 miles in length, which has proved very successful; all other British electric railways are of the suburban type, operated, with one exception, on the multiple-unit system, without separate locomotives. The effect of electrification on railways formerly operated with steam has been most marked, and

there can be no question that electric traction is *par excellence* the right thing for suburban service. But Mr. Smith lays special emphasis on the fact that even with so dense a service as that on the tube railways, the annual load factor (on the basis of the maximum demand averaged over one hour) is less than 50 per cent., so that those who look to railways to produce a great improvement in load factor will certainly be disappointed; as a rule it is lower than 40 per cent. in this country, and not much higher in the United States.

We are glad to see that Mr. Smith does not approve of the practice, imposed upon us by legislative restrictions, of erecting a separate generating station for each railway. The extreme importance of continuity of supply in the case of a railway has, of course, weighed with the railway companies in the past, but, no doubt, under the Ministry of Transport, and with the Electricity Supply Bill in operation, adequate safeguards will be provided, and the railways will derive their power from large public generating stations.

With regard to the system of supply to be adopted, Mr. Smith makes it clear that the high-pressure direct-current system has the preference. As it is good practice to run a suburban service quite independently of main-line traffic, he does not anticipate any trouble due to interference between the two in this respect, and the time has not yet come to fix standards for main-line working—though, of course, that will have to be done eventually. Mr. Smith contemplates a working pressure of either 1,500 volts, or, if that is not sufficient, 3,000 volts, for main-line electrification. Both pressures have been used successfully, and in view of the trend of progress and the requirements of heavy electric traction, we anticipate that the higher pressure will win.

LIGHT AND RELATIVITY.

The announcement that was made recently at a joint session of the Royal and Astronomical Societies anent the results obtained by the British Expedition to Brazil, to observe the eclipse of the sun which took place on May 29th last, has aroused great interest among all persons concerned with the physical sciences. The interest aroused is the more intense, because the principal result, namely, the deflection undergone by a ray of light, owing to its passage near our sun, had been made the subject of prediction by Prof. Einstein. He, reasoning from the relativity theory of gravitation, had reached the conclusion that the deflection should amount to about $1\frac{3}{4}''$, whereas arguments based on the ordinary Newtonian system of mechanics made the deflection but a half of this, or less.

Prof. Oliver Lodge, for example, without committing himself to prediction, favoured the anticipation that the deflection observed would approximate to $\frac{3}{4}''$, which is the amount to be expected if the wave-front of a ray of light possesses the property of mass, and there are many other causes to which such a deflection might be ascribed, each of which would require that a somewhat different magnitude should be observed. Consequently, a certain element of what is called sport entered into the feeling with which the result of the observations was awaited, and so heightened the interest with which the announcement was received. It seems, perhaps, a little extraordinary that conclusions so fundamental regarding light and gravitation should stand to be decided by the measurement of so slight a thing as an angle subtending but a second or so of the circular arc, and on one that can be made only on such rare occasions as when the light from the sun is cut off by an eclipse. The fact is, however, that we have never known much that is fundamental concerning either light or gravitation. Concerning detail our knowledge is wonderful. We know the length and frequency of light vibrations and the energy they represent, while the law of gravitation can be demonstrated by the difference of weight an object has when weighed in the upper and lower stories of a building; but to explain what happens to light during the eight minutes it takes to reach us from the sun, we have had to invent the luminiferous ether and endow it with incompatible properties; while to explain how the force of gravity is transmitted across the solar system, we have played with still more extravagant hypotheses. Indeed, both the phenomena exhibit peculiarities which, so far, defy explanation on ordinary mechanical principles. Those who have read the article by Mr. R. W. Western that appeared in our issues of September 26th and October 3rd last, on the Principle of Relativity, will have seen that the behaviour of light in certain experiments constrains us to throw over the laws of motion as enunciated by Sir Isaac Newton and replace them by modified formulæ. Prof. Einstein has further developed this principle so as to embrace the force of gravity. The difficulty of accounting for its transmission (which must be instantaneous or at velocities far exceeding that of light) is then got over by regarding it as due to acceleration. One descending in a lift, with the acceleration of a body falling freely, would find himself for the time being unaffected by the force of gravity. His feet would no longer press the floor, or, rather, the floor would no longer press his feet, and if he dropped his pencil case it would not fall, but remain suspended where his fingers had released it. In the same way, were the lift accelerated upwards at the same rate, he would find his weight doubled, for the time being, and his pencil-case would fall at twice its usual rate. The theory provides for every field of gravitation an equivalent direction and speed of acceleration, but to reconcile this state of things with ordinary conditions as we know them, multidimensional space must be invoked, by the help of a new mathematics. It is not, on the face of it, easy to see what is gained, when, to explain gravity, which is difficult to understand, one must employ multidimensional space, which it is impossible to conceive, but those who are curious on the subject may consult Prof. A. S. Eddington's admirable Report on the Relativity Theory of Gravitation, published by the Physical Society last year. Whatever difficulties the theory presents, there are already two facts accounted for by it that have not hitherto been otherwise satisfactorily explained. First, the discrepancies in the perihelion of Mercury. Second, this deflection of light passing near the sun. There remains another test, and that is provided by the fact that the theory requires a certain displacement of the spectral lines towards the red end of the spectrum. This displacement has not, so far, been demonstrated, and as a theory of this kind, because it is universal, must be compatible with all facts, or fail, there is still room for an open mind as to the nature of the force called gravity.

The Status of the Engineer.

In our "Notes" columns will be found an announcement of the greatest importance to all professional engineers—namely, that the Council of the Institution of Civil Engineers has decided to introduce a Bill into Parliament to secure statutory powers for the registration of Civil Engineers—including members not only of that Institution, but also members of the important engineering societies and others outside those limits. The Council is to be congratulated on taking this step, which will be welcomed by all who are solicitous for the honour and welfare of the engineering profession; it is a movement which we have advocated for many years, and if successful—as we hope it will be—will place the profession on the same footing as the legal and medical professions.

Everywhere on the Continent the engineer has long been recognised as a professional man, qualified by long and arduous training to fulfil functions of the first importance to society, and to occupy positions of the highest responsibility and trust; in this country alone, governed by men of classical training and restricted mental horizon, is the engineer still regarded as a man in overalls, armed with a spanner. And he is paid accordingly.

We trust that every engineer will give his cordial and energetic support to the proposal—not only the members of the premier Institution—for the matter intimately affects every one of them, and all will benefit by the improved status that will result from its accomplishment.

Electrical Trade Unions.

We do not know why the electrical industry should be singled out for interminable petty warfare between Trade Unions; so far as we are aware, there is no such antagonism between Unions associated with other branches of engineering, but perhaps it is due to the comparative youthfulness of the electrical industry and of the Unions connected with it, that a stable conditicn has not been reached. The contest between the E.P.E.A. and the E.T.U. is apparently perennial; it is well known that the latter desires to swallow up the former, and has threatened the livelihood of any of its members who join the Association. In another direction we find the National Association of Supervising Electricians at loggerheads with the E.T.U., the cause of discord being practically identical in character—that is, the E.T.U. desires to abstract from the N.A.S.E. all the foremen, though it would apparently agree to allow the supervising electricians to remain outside its ranks (for the present ?).

There are three features common to both these quarrels: —(1) The E.T.U.; (2) the fact that both the other bodies secured registration as Trade Unions solely for the purpose of obtaining representation on the Whitley Council; and (3) the inability of the latter bodies to gain admission to the General Federation of Trade Unions, which is the hallmark of a *pucka* Trade Union.

Features (1) and (3) are interdependent, in that it is the opposition of the E.T.U. which prevents admission to the Federation; it seems that the adverse vote of one Union is sufficient to blackball a candidate for admission. In each case it is the E.T.U. that is the aggressor—the other bodies earnestly and, we believe, sincerely protest that they harbour no ill-will towards the Electrical Trades Union.

As a matter of fact there is strong reason to believe that it is not even one Union that opposes the recognition of these two candidates, but only part of a Union, namely, the London Branch of the E.T.U. That branch is known to be insubordinate to the Executive of its own Union, and to be, in fact, a focus of strife and political unrest, and we see it getting its own way in opposition to the views of a far greater number—a triumph for democracy!

We understand that the E.T.U. proposed to form a special branch for foremen, but the latter after full consideration rejected it—naturally, it would be an impossible position for the foremen to be in the same Union as the men. The Supervisors' Association has, therefore, declined the offer of the E.T.U., and will stand by its own members. A deadlock has been reached, and the E.T.U. is at the bottom of the mischief—as usual.

Supply Troubles in Paris.

The situation of the works in the vicinity of Paris is far from favourable at the present time, when regarded from the standpoint either of the maintenance of the supply or the financial results of the undertakings. According to a report of an interview with M. Passerieu, Secretary of the Section Fédérale des Forces Motrices, even if the coal crisis did not exist, and the quality of the coal were the same as in pre-war times—which is not the case—it would be impossible for the generating plant at the stations to cope with the consumption in consequence of the increasing demands for energy. It appears that the stations are unable to meet the peak demands, and it is necessary, it is said, to level the consumption curves. The demand makes very great leaps and bounds in the case of some stations during the same day. For instance, the demand amounts to 8,000 KW. in one station in the suburbs of Paris at 6 a.m. An hour later the engineering works and other establishments open their doors, and the demand immediately rises to 45,000 KW., falling to 15,000 KW. during the period for breakfast. In the evening the conditions are worse, in consequence of the public and private lighting coming on, and the production reaches 50,000 KW. between 5 and 7 p.m., declining to 10,000 KW. at midnight.

It is of particular interest to hear what the secretary has to say regarding the quality of the coal and the methods adopted to secure its combustion. He states that the consumption of coal is substantially the same during both the period of low demand and that of the highest demand, the explanation being that the coal is of an inferior quality, and is composed, for the most part, of soil and dross. In order to burn this coal it is found necessary to add very inflammable materials, such as naphthaline and benzol, &c., the vapours from which render intolerable the atmosphere in the boiler-houses. As a consequence the men, who are already overworked, work under deplorable conditions, and run the risk of darts of flame, and even of explosions. If the present situation is not soon remedied as a matter of urgency, it is considered that a large number of the men employed at the engineering and aviation works in the vicinity of the Seine will soon become idle, and there is said to be no remedy other than that of equalising the consumption. If nothing intervenes, it will be impossible to ensure the service, particularly at 5 p.m., when, simultaneously with the consuming works in full operation, the tea tangoes and the shops are brilliantly lighted, thus showing absolute indifference to the present crisis. The men employed at the generating stations have asked for higher wages, but the unfortunate financial position of the companies has prevented them from conceding the demands which are considered to be legitimate, unless at the same time they are permitted to raise the charges for supply to customers. As bearing upon this matter, it is pointed out that prior to the war 75 per cent. of the energy produced was utilised for lighting purposes, whereas at present the quantity used for power purposes is 75 per cent. of the total production, and is supplied at less than one-half of the price charged for energy delivered for lighting purposes.

It rests with the public authorities to find a solution of the problem in the interests of both the companies and their staffs—a solution which is all the more necessary inasmuch as the companies were required to facilitate the operations of the consuming industries which were developed in the neighbourhood of Paris for the purpose of promoting the national defence during the war.

Heating Problems.

In spite of the assistance given by the Department of Scientific and Industrial Research, the provision of the necessary funds for carrying on various researches is not always an easy matter. A case in point is the Institution of Heating and Ventilating Engineers, which a short time ago received a grant for a research on heating problems. The members of the Institution, as is usual, were asked to provide a similar amount of money, and that was done, but the funds are nearing exhaustion, and the research is far from complete. Taking a broad survey of the situation, the Council of the Institution of Heating and Ventilating Engineers has come to the conclusion that the work is of too comprehensive a character to justify the burden of the whole expense being placed upon one Institution, and it has decided to invite other institutions whose interests may be said to be allied, to a conference with the view of endeavouring to obtain some financial assistance. Electric heating, of course, comes within the scope of the research, and we imagine that the electrical industry will be invited to take part in the conference. The research that has been carried out deals for the most part with the heat loss through walls of various materials, and it is not at all unlikely that, in connection with the electric heating of rooms, this is a factor which has been almost entirely ignored. Sufficient evidence has been accumulated that this loss is very much greater than is generally supposed. Indeed, until this research was undertaken, it was to all intents and purposes ignored in all heating installations, but if by the employment of suitable building materials this loss can be eliminated to a considerable extent, it means that the efficiency of electric heating is improved to that extent. Heat loss through walls is certainly a problem which cannot be left out of account in dealing with electric heating problems, and it is another instance, as in the case of lighting, where the electrical engineer might well collaborate with the architect and the heating engineer.

PRACTICAL POINTS IN THE LAYING-DOWN OF MOTORS AND SWITCHGEAR.

By JAMES WALKER.

Electrical engineers in charge of plant in factories are at all times anxious to compare their own lay-out of plant with that of their brothers in some other factory, and it is for this reason that visits to works are so popular with several associations.

Those who participate in visits of this kind are sure to notice something original in the rig up of switchgear, in the laying down of motors, or in the running of supply mains.

At the same time one must be prepared to see a good deal of temporary work in the layout of electrical plant, and more especially is this so in works where a great deal of shuffling of plant takes place due to extensions and alterations of workshops. However, one can usually tell what is really a temporary job and what is a finished, or supposed to be finished, one.

Another method of comparing notes, as it were—and one which does not entail travelling to some other district—is to study carefully the photographs which appear regularly in these pages. For instance, we are often treated to a full description of some supply company's works, or of the layout of plant in Messrs. So-and-So's establishment, and by studying the photographs illustrating these articles we are able to see how things have been done. It is really amazing how often one can see an otherwise first-class layout spoiled by several cables or wires hanging around a motor casing, or in the method of running the tubing or cable from the switchgear on the wall to the motor seat.

What the writer usually notices on many jobs is that the wiring has been done on the "direct or get there system." It seems to be a case of "get them there, the machine will run just the same." Of course it will, but to have a little more reliability and safety a little touching up here and there would make all the difference, and then there is such a thing as making a job look sweet to the eye.

Fig. 1 shows the original layout of a 60-h.p. a.c. motor switchgear, the work, one must admit, of an amateur.

Note the elaborate get-up of the iron framing and the number of points where it is a case of "giving a healthy man a crutch." Notice also that the main switch is for wall mounting, and yet, for some reason or other, it is stuck on a frame which projects 5 in. or 6 in. out from the wall, taking up, by the way, valuable space at the corner of the doorway.

Then, again, take the rotor starter; this is fixed to the frame at A by means of bolts and nuts, and the clamping plate underneath. Why the frame wasn't spread a little to catch up the centres of the starter, only the designer knows.

The same remarks apply to the method of fixing the frame feet to the floor; one bolt and a plate which is never in its place.

The tubing of the mains is run, as stated before, on the "direct system." Fig. 2 shows the same gear rearranged and erected within the butt of the wall and all clear of the entrance to the workshop. The main switch is mounted direct on the wall and the rotor starter fixed to an angle iron frame, which consists of two legs built into the wall and a 1½-in. platform of wood bolted between them.

The starter would have been bolted direct to the angle irons and the platform done away with, but two of the lugs had been broken off in the original rigging up. The wiring was put in fresh tubing and the switchgear screwed to suit, thus completely covering all wiring and complying with the regulations.

Now, all the blame for shoddy work cannot be put down to the electrician who wires up the job. For instance, the wiring, whether done in tubing or with cable, may be quite a tidy job, but the finishing up at the motor may be anything but neat, and all due to the many different ways in which terminals are brought out on the carcass of the machine. For instance, one maker has the ends brought out to a terminal block (as shown in fig. 4), another as in fig. 5. All that can be said of the method illustrated in fig. 5 is that the designer either could not be bothered making up a terminal block or that, being of a very sensitive nature, he did not want to be the means of adding still another idea to the dozens now in use.

Makers may say that they will supply any kind of block if specially asked for, but why should it be necessary to make special request? Factory engineers, when ordering a motor, take it for granted that the eyebolts and feet will be of sensible design and size without specially mentioning the fact.

The same should apply to the terminal block, where, after all, what is wanted is not so much standardisation of blocks, as common-sense methods of bringing out the ends to suit the wiring practice of to-day.

Regarding the fixing of terminal blocks on motors or dynamos, we also have a great variety of positions, and it is quite evident that several of the makers really do not know what is required. They are, it is admitted, always anxious to meet the requirements of the factory engineers, but perhaps it is because they have had so many ideas put before them that they are really in a fix to know what is the best place for fixing the blocks. However true this may be, there is certainly no excuse for the designer who thinks that, after all, the best place to put them is out of the road altogether, and, consequently, he puts the terminals underneath the machine carcass. Those responsible for these out-of-the-way designs would be well advised to steer clear of the fellows who have developed kinks in the neck when coupling up these machines.

There are one or two other details to which attention could be drawn, as, for instance, the method of connecting up the shunt coils of a machine. What one usually finds is a helpless-looking piece of thin flexible which hangs like a suspension bridge between the coils, and, knowing quite well that it is doing very important work, considers itself worthy of a rest now and again. The armature supplies the needful until the flexible one day gets worn out, or usually blown out of existence. The copper rod connection is what is wanted here, coupled into terminals bound to the coils themselves. One can quite understand that the extra copper will cost a few pence more than the flex, but this continual cutting down in important details of machines is gradually reaping its own reward, and, personally, the writer knows of one firm, of good reputation, too, which has received its last order from a certain works because these same works have been let down badly with a new machine installed just eighteen months ago. The engineer informed his manager that he would soon require a spare armature, or have to fit a new commutator on the present one, because when another turning was taken off the commutator it would be just about played out. The copper is very scarce, and has only been turned once since being installed. These makers have been scored off the "buying list."

Now take the switchgear makers. A d.p. main switch, fuses, starter, and regulator are required, say, for a 10-h.p. motor. In come the quotations

for the same, and we read: "the above gear will all be neatly fixed on an angle iron frame with the necessary cross straps where necessary, and suitable for wall fixing." Out goes the order to one of the best suppliers, and we patiently await delivery. When the gear does come, what do we find? Nothing more or less than the waste of good iron, bolts, or rivets. This is the conclusion the writer has arrived at after having installed the gear of several first-class suppliers. The angle iron and

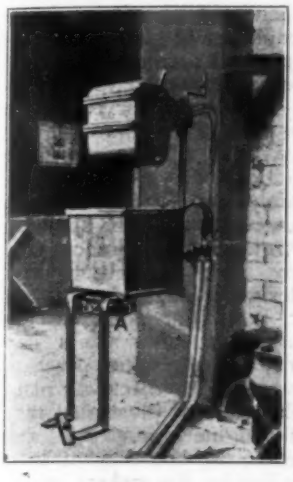


Fig. 1.

Fig. 2.

cross straps are all there for quantity, and the space occupied by the whole arrangement is absurd. We know quite well, as far as space is concerned, that we could have combined switches and fuses, combined starters and regulators, but these do not always suit the circumstances. Engineers are all familiar with the arrangement of gear just mentioned; the angle irons and the cross straps. Let us study their uses. The main switch centres are, say, 9 in. across, the regulator 12 in., and the starter 12 in. First of all, in making up the frame, the top and bottom ends of the uprights are bound

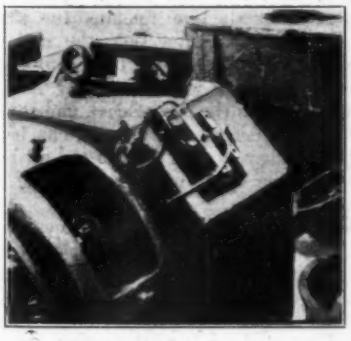


Fig. 4.

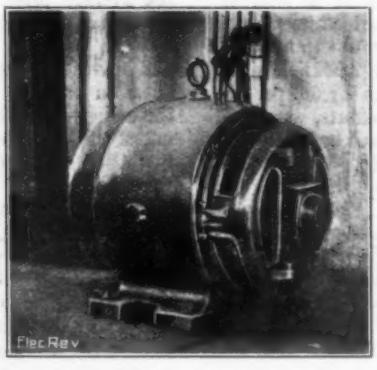


Fig. 5.

together with a cross piece, then the starter and regulator are screwed direct (sometimes not) to these uprights, but to catch up the centres of the main switch two cross pieces are riveted to the uprights, and all the gear, in most cases, spaced well apart. What the writer cannot understand is why the angle irons are not set to catch up all centres direct without the necessity of having to fix cross straps, and also why so much space (and iron) is lost in the spacing out of the gear. The same remarks apply also to the switches and starters mounted on sheet iron panels fitted with lugs for wall fixing. Is it quite necessary to use 4 or 5 sq. ft. of good sheet iron on the assembling of the switchgear which, in itself, is quite healthy and strong enough to be fixed to a simple flat iron frame?

Fig. 3 shows two sets of switchgear A and B, mounted on iron frames, and one set C as fitted up by makers.

The writer has had occasion to reconstruct several

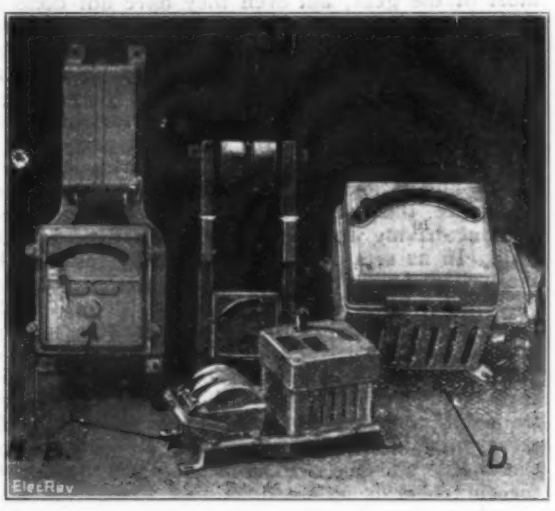


Fig. 3.

pieces of switchgear for D.C. motors, ranging from 1½ H.P. to 10 H.P., and has adopted the arrangement of fixing the main switch direct to the starter case, as shown at D. Originally the two, in some cases, were screwed to the wall, one above the other, or at the side of each other, and sometimes as much as 18 in. to 24 in. apart, with the cable hanging between them. In cases where the starter is of fairly large dimensions compared with the main switch, this arrangement of coupling the two together answers very well, and does away with the need for a supporting frame, and, incidentally, makes

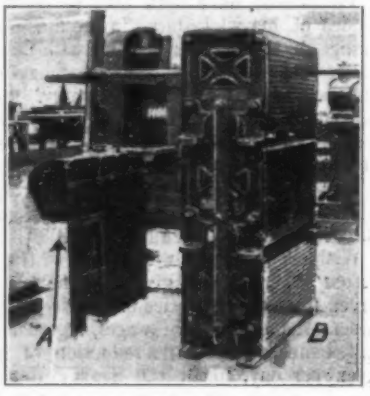


Fig. 6.

a very simple job of the wiring. It also shows that it isn't always necessary to have frames or sheet iron panels on which to mount switchgear, and also that we do not require to stick to the everyday arrangement of having the one above the other.

One of the worst sets of apparatus the factory electrical engineer can get put in his hands, as far as making a neat job of the lay-out is concerned, is the control gear consisting of a main switch, controller, and resistance boxes (two or three of the latter, as the case may be) for either D.C. or A.C motors. Quite the usual practice, the writer has noticed, is to have the main switch on the wall, the

controller well (?) stayed with straps to the crane or other machine, and the resistance boxes laid out on the floor, sometimes in the form of a seat, and nicely covered with an old bag or two. This isn't a "fine tale"; it is quite common in many works and collieries. The writer has no hesitation in saying that only a few makers of this control gear have actually put on the market at half-decent rig-up of most of the gear, but even they have not done all that should be done. Why can't the main switch, either D.P. or T.P., be fixed to the controller, and made part of the design, without sending it on as a separate unit to be fixed "wherever they can get it"? The only really practical place for the switch would be to the side of the controller and under a cover of its own. Then one could work with safety on the fingers and contacts, and also, should a lock take place, the attendant can switch off immediately without having to run to a switch fixed on the wall. In 22 sets of this gear recently installed by the writer the switches were fixed as shown in fig. 6A, which speaks for itself. Having got rid of the main switch and controller, which we notice has one hole in the base large enough to take all the leads and is not riddled with holes, one opposite each contact, up the back as some are, we turn round and wonder how we are to make a decent lay-out of the three resistance boxes, two of which the makers call size M and one size X. In some of the designs the controller is mounted on top of the resistance chamber, thus forming one complete unit, and if the main switch were also attached it would make a very good job, but it isn't always possible, owing to the bulk, to adopt this type of gear.

It may be that the controller must be fixed in some position where it is impossible to provide room sufficient for the resistance boxes, and, therefore, these have to be placed at some distance from the controller. On floor-mounted jobs the resistances can be put one upon the other and bound together with straps, as shown in fig. 6B. It may be impossible, in some cases, to get the height required for this arrangement, and it then will be necessary to lay them out side by side on the floor. But why can't these resistances be made up under one cover, and as a complete unit?

Supposing they were, it would be quite a simple matter to examine the whole set of grids, or whatever they be built of, whereas at present it is impossible to do so unless the resistance boxes are disconnected one from the other, and their respective covers taken off. To do this is sometimes, owing to their situation, not such an easy matter as it sounds, and the handling does not do the resistances any good. There is certainly room for improvement in the design of this gear, and it must be admitted there would not be much trouble entailed in doing so.

The writer, in drawing attention to these few points regarding the design of certain parts of machines and switchgear, is not out to assume the rôle of expert critic, which post, after all, is very easily filled, but rather to give some practical opinions as to what is wanted for electrical plant in factories. Some of the lay-outs illustrated may not be to the mind of all engineers-in-charge, and some may be open to criticism, but they at least show that a great deal is left by the makers to the discretion of the electrical engineer on the job, which discretion may, or may not, be to the advantage of the makers themselves or of their gear.

THAT SIX SHILLINGS!

For the past fortnight or so Mr. Hodges, assisted by the *Daily News* and the *Daily Herald*, has been trying hard to convince the British Public that not only should the price of coal be reduced by 6s. per ton, but that the price should never have been advanced by this amount. Unfortunately, neither Mr. Hodges, nor any of the Labour Party members of Parliament, have been able to convince Sir Auckland Geddes of his wickedness in the first instance, or that by taking off the 6s. per ton he will be enabled to pay the miners their wages in full, without having to dip his hand into the treasure-box of the country. Sir Auckland some time ago promised to reduce the price even by 6d. per ton so soon as the miners, by their productive efforts, warranted a reduction, and we all hope that, as promised by *The Times*, a reduction of 2s. per ton is in prospect; by the time this issue is published it may be an accomplished fact, but, like the Scotsman, "We hae doots."

Without doubt the worst blow to the miners' Nationalisation scheme was given when the Government were forced to put up the price of coal by 6s. per ton, to pay the miners the advance in wages, together with the 14·2 per cent. increase due to the reduction of hours from eight to seven per day, under the Sankey Report. To meet this cost something like £26,000,000 had to be provided by the Treasury, and, quite rightly, the Treasury expects to recover this amount from the profits due to the sale of the coal. Now if coal costs, say, 30s. per ton to produce, it cannot be sold for, say, 24s. without someone being out of pocket. Mr. Hodges, however, thinks it can, or in other words, he evidently believes 2 + 2 can be made into 5 instead of 4.

Let us examine Mr. Hodges's arguments—but it is only fair to say that he himself has admitted he has no great faith in them, because they are compiled from Government sources. The great difficulty that presents itself to the searcher after truth, is that there are no actual and positive data to build upon. Mr. Hodges, for instance, takes the estimate made by Sir Auckland Geddes in July last, adds to that the advance in price that has been obtained in export sales of coal given by the September returns, and by a plausible presentation of the figures, makes out that the Government will make a profit of £30,000,000, but even then, assuming that his own figures were based on actual facts instead of estimates, he only gets the price down by 3s. 8d. per ton. But in order to do this, he assumes that 32,000,000 tons of coal will be exported at the average price (taking the figures at the end of the September quarter) of 57s. 9d., and at the same time assumes that the cost of production remains the same, and leaves out of consideration altogether the cost, or effect on the cost, of the 18,000,000 tons of coal used by the collieries themselves. Miners' wages can only be paid out of the money received from the sale of coal, and in fact Sir Auckland Geddes has estimated two costs, one being the actual cost of producing a ton of coal at the pit-head of 26s. 0½d. per ton, and the other of 29s. 3d. being the actual cost of the coal sold.

Mr. Hodges also tries to back up his statement by assuming there will be a greater output than that estimated under the Sankey report of 217,000,000 tons, but it appears whilst Sir Auckland agrees there may be—if everything goes well—an enhanced output of probably 8,000,000 tons, it does not exactly follow, at any rate to the extent claimed by Mr. Hodges, that the cost of production will be materially lessened. The fact that there are now many more men employed in producing coal than in 1917, while the output is a great deal less, does not tend to the lessening of the cost of production. As an actual instance, Mr. Charles Markham, writing to *The Times*, says that in the Derbyshire group of pits (seven) belonging to his company, there are 1,000 more miners employed, whilst the output is 10,000 tons per week less. We cannot believe that Mr. Hodges would have the effrontery to claim that these men were doing their utmost to help the country out of its difficulties. He (Mr. Hodges), however, does not hesitate to threaten, as, speaking on the evening of the 14th inst., at the King's Hall, Covent Garden, he is reported to have said:—"The Government had rejected the report of the Commis-

sion at their peril. They had rejected it so summarily as to create a crisis of the first magnitude. Between now and March next year every member of the community would realise what the crisis meant, and if it developed, as he believed it would develop, the Miners' Federation could not be held responsible." Of course not, the Miners' Federation are never responsible for anything. They are to be allowed to hold a pistol at the head of the community with a "stand and deliver" attitude, reason or none, and if anyone gets hurt they are "not responsible."

Another move of the Miners' Federation is that unless the 6s. per ton is taken off the miners will demand a further increase in wages, and thus the heaven-sent blessing of Government control of the coal-mining industry goes on. Threats on one side for more, complaints against limitation of profits on the other, the Controller in between, knowing nothing of the industry, with no definite data or facts, relying on estimates, assuming nothing untoward will happen, and the poor consumer under them all, too heavily loaded with care and apprehension of coming disaster to protest. For Heaven's sake let us get rid of this stifling control, and hand the mines back to their rightful owners, after which we shall without doubt begin to make headway. It is the only way.

Meantime, from the statements made by Mr. Finlay Gibson, secretary to the South Wales Coal-owners' Association, we learn that coal hewers, instead of being paid 2s. 6d. per ton, as Mr. Hodges would have us believe, are receiving from 26s. to 45s. per ton, and Sir Auckland Geddes stated, a few days ago, that the actual average cost at the pithead was 50s. per ton, and no doubt, under Government control, some of the poorer pits must be losing heavily. Miners get 5s. per day for merely descending the pit, and if they get much less than a ton of coal, they get the minimum wage of at least 13s. 6d. Further, according to Mr. Gibson, the actual cost of production since the July estimate has gone up by 3s. 10d. per ton, made up of 2s. 8d. in labour and 1s. 2d. in stores and materials.

Yet we are asked seriously—under threat even—to nationalise the mines!

THE ELECTRICAL TRADES BENEVOLENT INSTITUTION.

On November 12th, at Oddenino's Imperial Restaurant, the Festival Dinner of the Electrical Trades Benevolent Institution took place; the president, Mr. H. J. Cash, was in the chair, and was supported by Messrs. C. H. Wordingham, past-president I.E.E., Hugo Hirst, W. B. Esson, R. W. Hughman, F. H. Nalder, W. R. Rawlings, L. G. Tate, R. J. Wallis-Jones, G. E. Taylor, H. Bevis, C. E. Hunter, F. B. O. Hawes (secretary), and others, but owing partly to the motor show, which rendered it impossible to secure hotel accommodation, many friends of the Institution were prevented from coming to town for the event, and the attendance was consequently much smaller than on previous occasions, the last of which was in 1914.

The printed list of contributions which was circulated at the Festival, and which we shall print later, contained the following totals:—Chairman's list, £328 13s. 6d.; Mr. H. Bevis's collection, £61 9s.; donations, £412 13s. 8d. —total, £802 16s. 2d. Mr. C. E. Hunter's collection also brought in a total of £1,337 15s. 6d., but this item belongs to the year 1918. A supplementary paper added £47 0s. 6d. to the chairman's list, and contributions from those present at the dinner brought the total for the Festival up to £888 19s.

We cannot but think that this is a deplorable showing for the great electrical industry—less than a beggarly thousand pounds! From Garcke's *Manual* we note that the total capital invested in the electrical undertakings scheduled in the *Manual* (excluding telegraph companies, which have their own benevolent schemes) in 1918, was over 450 millions sterling, on which sum the income of the Benevolent Institution amounts to the microscopic value of 0·0002 cent.

Can we adequately characterise such a result? The adjective "paltry," which was freely used at the Festival, falls far short of doing it justice—it is despicable, a matter for shame and indignation. Moreover, a large proportion of that mite comes from persons and firms who do not figure in the *Manual*, so that the record is even more damning than it appears on the surface. Now, what are we going to do about it? How shall we remove this stain—the only stain—from the escutcheon of our great profession and industry?

We make no "appeal" to the big companies, many of which have done so well in recent years, as the records of dividends in our "City Notes" will show; nor do we appeal to the powerful associations which are connected with the electrical industry, or to wealthy individuals. A few of them have generously contributed to the funds of the Benevolent Institution. No!—we say, shame upon them! Why are their names absent from the list? It is a crying shame and disgrace to the electrical industry as a whole that the invested fund of the Electrical Trades Benevolent Institution is even now, after 14 years, only £12,000—the annual income from subscriptions alone should be five times that amount.

After the loyal toast, Mr. Cash proposed "Prosperity to the Electrical Trades Benevolent Institution." He lamented the causes which had restricted the attendance, and remarked that the people he wanted to reach were those who were not present; the electrical industry had not "done its bit" in this matter. Let them look at the list of donations, and at the prosperity of the electrical industry at this time—the list was paltry. In so extended an industry some must fall by the way, and their fellows were bound to give them a helping hand. The fund was not large enough, the contributions brought in by the Festival were not what they should be; some 500 appeals had been issued from the office of the Electrical Contractors' Association, of which he was President, and as many from his own office, without overlapping; and some thousands had been issued by the secretary, Mr. Hawes. If every man appealed to had subscribed even one guinea, the list would have been many times larger—but even then it would have been inadequate, and many ought to subscribe much larger sums than a guinea. In many cases the neglect to reply was due, not to refusal, but to carelessness; and he urged the members, when they met their absent friends, to mention the dinner, and tactfully remind them that their names were not on the list. The Institution had to have the money, and it was up to them all to get it in. Most of the present subscribers were persons and firms who would never need help from the Institution; members of their staffs should be induced to join as members, subscribing 10s. per annum, thus helping the funds and securing their own future.

Mr. H. Hirst said he had been asked to support the appeal for funds, but as everyone there had done his best, he would address his remarks to those who were not present. As he had said on a recent occasion, the struggle for life was over, and now the struggle for a living was commencing; in that struggle as many fell, and needed assistance, as fell on the field of battle. Electrical engineers in this war had distinguished themselves by deeds second to those of no other class; those men were now back in civil life, displaying that love of their profession and that sense of duty which were characteristic of electrical men; they had taken many risks and incurred severe exposure, and might require help later on. For that purpose that Institution had been formed, but it was regrettable that so great an industry should show so poor a result as even their best record really was. The movement had, perhaps, suffered because the electrical industry was started by young men, who were so absorbed in their work that they grew old without realising the fact, and they were all so busy that they had no time for canvassing. The war had taught them the value of co operation, and great industrial institutions had come into existence; those powerful associations ought to be tapped. Many prosperous contractors not actually within the electrical industry, but connected with it, ought to be appealed to. An Institution such as this ought to have an income of £50,000 a year, and he was certain that it could be got if a campaign were organised on the lines he suggested. The movement must be kept alive all through the year, and its existence made known continually by all possible means.

Mr. C. H. Wordingham said the subject of the appeal spoke for itself, but funds of that kind received such a paltry return because the need for them was not brought before people sufficiently. They should put a few typical cases before their friends—suitably camouflaged to prevent recognition—to show what was wanted and to bring home to people the real necessity of support. With regard to the amalgamation of that fund with the I.E.E. Benevolent Fund, which had been suggested, he was satisfied that it was better to keep them separate; in the aggregate they would obtain more money as independent organisations.

A remarkable rarity in the shape of a golden sovereign was then put up for auction, but was first made the prize in a 5s. raffle, which brought in £13 10s.; Mr. Hextall (hon. solicitor), the winner, returned it for further exploitation, and with the President as auctioneer, it was successively sold to Mr. Hunter for £15, to Mr. Hirst for £20, to Mr. Hawes for £6, and finally to the donor, Mr. G. E. Taylor, for £5—total, £59 10s.

Proposing the health of the chairman, Mr. W. R. Rawlings referred to his excellent qualities as president, both of the

Benevolent Institution and of the Electrical Contractors' Association, and the toast received musical honours.

In his reply, Mr. Cash announced the result of the collection in connection with the Festival :—Chairman's list, £432 19s. ; Mr. Hunter's list, £211 ; Mr. Fletcher (G.E. Co., Ltd.), £63 (minimum) ; sale of sovereign, £59 10s. ; and contributions at the table, making a total of £888 19s. Referring to Mr. Hirst's suggestions, he said he had himself approached firms outside the electrical industry, with very satisfactory results ; it was a sound policy. Results could also be obtained by the tactful reminders to friends which he had suggested.

LEGAL.

Direct U.S. Cable Co., Ltd., v. Western Union Telegraph Co., Ltd.

Mr. Justice Peterson, in the Chancery Division of the High Courts, was engaged during several days last week in hearing this action, arising out of a dispute concerning the lease of a trans-Atlantic cable for a period of 99 years at a rental of about £60,000 a year.

Mr. Mark Romer, K.C., Mr. Patrick Hastings, K.C., and Mr. Whinney appeared for the plaintiffs, and Mr. Maugham, K.C., Mr. Douglas Hogg, K.C., and Mr. Tildesley Jones were for the defendants.

Mr. Romer's statement of the plaintiffs' case was to the effect that the action was brought to obtain relief under the Defence of the Realm Act. The plaintiffs, who were an English company, were owners of one of the great trans-Atlantic cables connecting this country with the United States, and in March, 1912, they granted a lease of the cables to the defendants, who were an American corporation, for a period of 99 years at a rental exceeding £58,000 a year. The lease contained a covenant under which the lessors were to repair and renew the lines and maintain through communication. To ensure this being done penal clauses were inserted in the agreement, and power was reserved to the lessees in the event of continuous interruption for 18 calendar months to give notice determining the lease altogether. Interruptions had taken place, and notice to determine the lease had been given. The case for the plaintiffs was that they were prevented from carrying out repairs and restoring communication by reason of the control exercised by the Admiralty during the war over the only available cable repairing ship, and that being so they were entitled to relief under the provisions of D.O.R.A.

Mr. Maugham contended that D.O.R.A. did not apply. Even if the plaintiffs were able to establish that they had used their best endeavours to repair the cable and that either owing to the war, or repeated storms, or any other reason they were unable to do so, the mere physical fact that there had been this continuous interruption gave the defendants the right to determine the lease.

Counsel alleged that between March 1st, 1912, and October 31st, 1919—some 2,800 days—through communication had been possible only on 1,378 days, a percentage of 49.2. The breaks were primarily due to the age of the cable, which was laid in 1874.

The hearing was adjourned until next sittings for the defendants to bring witnesses and records from America to prove the interruptions complained of.

Embezzlement by an Electricity Official.

Nottinghamshire magistrates, at Mansfield on November 12th, dealt with a case in which Henry Heys, a former chief clerk and collector in the Corporation Electricity Department, was charged with embezzlement. The Town Clerk (Mr. J. Harrop White) explained that the prisoner entered the service of the Corporation in 1908 and left to join the Army in 1917. During that period he apparently discharged his duties satisfactorily, and it was not until his work was taken over by other clerks that discrepancies were found in the books, the deficiencies coming under three heads—amounts received and not paid in at all, accounts received of which portions had been accounted for, and falsifications by carrying forward in the books a less amount than should have been entered. Generally the amounts not accounted for were slot-meter collections. The total defalcations were more than stated in the summons. Prisoner had served in the Army, and had recently been demobilised. He appeared on a summons. He (Mr. White) did not press the case, and he had the authority of the Electricity Committee to say that they desired that the accused should be dealt with by the Court. There were certain domestic reasons which had caused the committee to come to this decision.—Mr. E. F. J. Holicombe Hewlett, engineer of the Corporation Electricity Department since 1903, who gave evidence, stated, in reply to Mr. F. P. Marchant, who appeared for prisoner, that Heys had applied for permission to join the Army early in the war, and his salary was £150 a year.—Frederick Charles Lees, a collector employed by the Corporation, proved having collected certain sums which he paid to Heys, and Mr. Bernard Barnett, chartered accountant, who had investigated the matter, said there were sums of £66, £51, £2 and 10s., which had not been entered in the cash account, accounted for, nor paid into the bank. There was also an amount of £25, and the item was brought forward in the books as £15. Heys was then charged with embezzling about February 18th, 1916, £66, and on May 6th, 1916, another sum of £2. Prisoner pleaded guilty, and addressing the Bench on his behalf, Mr. Marchant said Heys in September, 1914, got into the hands of bad company, and, finding himself in financial difficulties, yielded to the temptation of "borrowing" in hope of repaying the money. As invariably happened, however, in such cases, his luck did not turn, and he was never able to replace the money. He volunteered to join the Army in August, 1914, and September, 1915, but his employers could not spare him until 1917. He made no attempt to evade responsibility for his action, but came straight back to England and took an appointment under one of the Metropolitan authorities. In two and half years' Army service accused had not had a single conduct sheet entry. His one desire was to make full restitution to the Corporation and to re-establish himself in life. He asked the Bench to consider whether in this case they could not apply their powers under the Probation of Offenders Act.—Evidence as to accused's previous good character having been given, the Chairman of the Bench said the case was a most painful one. There had been temptation and accused had fallen, but that was no justification for him to take the money. Considering his previous character and domestic circumstances they sentenced him to six weeks' imprisonment only.

Electrical Engineer Charged.

The *Times* reports that at Old Street Police Court on the 12th inst. Alfred Woods, electrical engineer, of Islington, was committed for trial charged with stealing a 5½-h.p. Century electric motor valued at £100, the property of Messrs. McGlennon & Co., printers, of St. Luke's. It appeared that while prisoner was overhauling certain electrical motors a 3½-h.p. motor was substituted for the 5½-h.p. one the man was supposed to have overhauled. The Century motor, it was alleged, had been sold by the prisoner to a firm at Leeds. Woods urged that the substitution was an accident.

Sentence on Electrician.

At the North London Police Court recently a Tottenham electrician named Mason, aged 21, was sentenced to six months' imprisonment with hard labour on the modified Borstal system for thefts at a number of houses in different parts of London into which he had gained an entrance on the pretext of having been sent to examine electric lighting fittings, &c.

British Thomson-Houston Co., Ltd. v. Corona Lamp Works, Ltd.

In the Chancery Division on Monday, before Mr. Justice Russell, this case was mentioned by Mr. Kerly, K.C.

Counsel, who appeared for the defendants, asked that the action should not be tried this sittings. He said the pleadings were closed in 1917, but notice that the trial had been set down was only given to the defendants in July last, and their experts had since been engaged on a 40-day case in that division. The present case was about electric lamps, and entailed very delicate experiments, involving, amongst other things, the life of the lamp, these experiments having to run over a very long time. There was a difficulty also in getting the material.

Mr. Colefax, K.C., opposed the application. He said the plaintiffs were ready to proceed. He failed to see how any experiments could be relevant to any issue at present raised in the case. His clients were really anxious to get on with this action. He was prepared to agree to a postponement to Tuesday fortnight, December 2nd.

His Lordship said the case had better go over until next sittings, in order to give the experts an opportunity to complete their experiments and evidence.

Large Electric Freight Locomotives.—The exhibition of a new 250-ton electric locomotive by the Pennsylvania Railroad at the recent convention of the Master Mechanics' and Master Car Builders' Associations marks a fresh advance in methods of moving heavy tonnage in large units over steep gradients. The locomotive has a maximum accelerating power of 7,600 h.p. and a sustained capacity of 4,800 h.p. for one hour. With two of these locomotives it is possible to haul a 6,300-ton train up long gradients at a constant speed. In the acceptance test of these locomotives such a train was hauled up a gradient of 1 in 100 at an average speed of 20.6 miles an hour. In spite of the great capacity of this unit it was built within existing operating limits. It attains the maximum starting drawbar pull which average freight cars will permit. The maximum tractive effort consistent with the wheel arrangement employed is developed, and the allowable maximum weight on the driving wheels is not exceeded. The maximum horse-power per unit of weight and the greatest speed considered desirable are also attained.—*The Times.*

THE INSTITUTION OF ELECTRICAL ENGINEERS.

Inaugural Address of Mr. Roger T. Smith, President.

(Abridged.)

Public tributes during this year have been paid to those members of the Institution who have served through the war and to those who have fallen in that service. In addition, I only wish to remind you of our corporate and individual pride in those who have served and those who have fallen. I wish the members of the Institution not to allow their pride in our victors or in our dead to diminish with time. No better evidence of that pride can be given than in fulfilling that "dear obligation" of the Royal Proclamation of September 15th last by the preferential employment of the disabled in electrical work for which they can be fitted.

The signing and ratification of Peace, and the problems which peace has brought, are testing and will test the temper of the nation to the uttermost. An outstanding feature of our public life, and of our Press, during the last few months has been and still is the passion for destructive criticism. Now that the time has come for rebuilding society, every effort to do so is withered by fault-finding without any attempt to put forward a considered alternative. The war has taught us that no man has the right to be only a specialist and some of the present unrest is due to the refusal of the wage-earner to be a specialist for so large a part of each day that he cannot be anything else. Good citizenship is as important as a man's trade or profession, and to bodies of educated men such as constitute this institution, the nation must look for providing the constructive criticism essential to the formation of that public opinion which alone can enable a democratic government to succeed in creating society afresh.

It is the custom of Britons to decry their education, and to compare it unfavourably with that of some other nations, but only the few spend time and thought and money to remedy agreed defects.

What this country requires is that more and more boys should be able to imbibe something of the advantages of our public schools and of the university atmosphere of Oxford and Cambridge. It may be possible so to cheapen university and even college life, that the traditions and teachings of the old universities may be available for men who cannot now afford them. It is satisfactory to know that the University of London has decided to institute degrees in commerce, and efforts are being made to raise half a million pounds sterling in order to endow the scheme adequately.

The Government has undertaken to set up commissions to inquire into the present position of both Oxford and Cambridge Universities. Relative to this inquiry the Education Committee of the Parliamentary Labour Party has asked that it may extend to a more economical utilisation of university and college funds so that, by decreasing the cost of living in college, poor men with brains may have as good a chance as rich men without brains to profit from the advantages of a university career.

It is essential to this Institution, and to the industry it represents, that our systems of education shall produce men capable of electric research. Nine American universities have each individual incomes exceeding the sum total of the parliamentary grant to the whole of the corresponding universities and institutions in the United Kingdom. It is obvious that students' fees cannot pay for research, and it is, I maintain, one of the duties of this Institution to see that our universities and technical schools are encouraged by suitable grants to promote original scientific research. From these trained scientific research workers must be drawn men capable of efficient industrial research. There is little in the science-teaching in the schools from which our older universities are largely recruited, to stimulate in boys a taste for research, and for the present we must look chiefly to our State-aided secondary schools to provide research workers. Some 9,000 boys leave these schools in the United Kingdom each year, and it is estimated that about 1,000 of them pass on to one or other of our 18 universities. Every influence, individual and collective, must be exerted by the Institution to secure research students at these universities and at the technical colleges.

It is significant of the widespread understanding in the United States of the importance of research in industry, that last July the American Federation of Labour issued a manifesto on scientific research in which they called on the Federal Government to foster and support scientific and technical research as essential to the well-being and progress of industry.

The fear of government support for research in this country is the application to the research worker of those official methods of control which obtain in Government departments subject to the Treasury. It is to be devoutly hoped that our research workers are not going to be turned into civil servants. The ordinary research worker can only specialise in one subject at a time, and if he successfully specialised in civil service he would lamentably degenerate in research.

The war has shown that among the great assets possessed by the British race is the sporting instinct which makes men and women put the admiration for excellence of performance, for fair play, and for chivalry, before the desire to win at all costs. There are ample signs in recent industrial events, not excepting the railway strike, that, in the difficult and perilous times present and to come, British common sense and the sporting instinct, if properly appealed to, will lead to a permanent working understanding between capital and labour.

But before the sportsman in the wage-earner can be appealed to it is essential that the employer should set the example. All business is founded upon a system of profit and loss, and one of the reasons why profit-sharing schemes are unsatisfactory is that the wage-earner without capital cannot afford to lose, and the system is one-sided. A man cannot be a real partner in business unless he can afford to lose. The ability to lose as well as the ability to win, is the essence of the sporting instinct, and in business the capable employer learns both as part of his daily routine. If in dealing with the wage-earner the employer develops his own sporting instinct to the highest possible degree, and endeavours to work upon the same instinct in those with whom he deals, it is, I think, certain that with patience and time the labour problem in our industry will be solved.

Is it too much to hope that the working of industrial councils, or if they are not adequate, some other organisation of the same sort, may in due time put an end to the hundred years' industrial war in the new society which we have all to help construct? As industrial councils or their equivalent are formed, it is hoped that they will be permitted to deal with all matters of principle in the relations between employers and employed, but we must look to the working out of detail not for an entire industry, but in each individual shop through its shop committees.

Such contact as I have had with my fellow countrymen generally, and with the wage-earner in particular, has convinced me recently that the gift of common sense is much more general than I once thought it to be. If I am right, we have not much to fear. Its great enemy is personal vanity, and the possession of personal vanity in either employer or wage-earner, or often in both, is a very frequent obstacle to the settlement of disputes, as well as the prime cause of most of them.

The question of an electrical proving house has been fully discussed within the Institution. It is to be hoped that manufacturers and traders in our industry will discuss it as a business proposal. I do not think too sanguine a view can be taken of the importance, both to our home and our foreign trade, of the standard specifications of the British Engineering Standards Association. It rests with the manufacturers not only to comply with the standard specifications when the users ask for it, but to educate the public to demand British standard materials or articles, not only in the British Isles, but in the Dominions and in foreign countries.

It is this education of the user, by manufacturers and their agents, to realise that it is to their advantage to ask for a British standard article rather than one that is not standard, which is one of the really important matters of reconstruction, and in no industry is it more important than in the electrical industry.

Obviously by the time this education of the public bears fruit, it will be a great advantage to have a proving house to say authoritatively if materials or manufactured articles comply with the British Standards or not.

Another matter affecting our industry very closely is the patent law. Before the 1919 Bill becomes an Act, it is to be hoped that some of the disabilities under which the genuine inventor has laboured in the past will have been removed by amendments.

As an example of the Institution's co-operation with other bodies, a passing reference may be made to the Institution's share in the formation of the new Society of Radiographers for securing the efficient training and registration of lay helpers in radiography. Arrangements have been made by the medical profession for the granting of a diploma by Cambridge University in the subjects of Radiology and Electrology for medical men engaged in this class of work. It is hoped eventually to develop an educational scheme in teaching centres throughout the country, as well as in the chief hospitals, in order to train men for this diploma. In this way it is intended to raise the status of medical men practising these branches of medicine in which electrical science plays an important part.

As a result of the report of the Indian Industries Commission early this year, the Indian Society of Engineers was formed to include all branches of the profession. It has received the support of the Indian Government, and this Institution is represented on the organising committee. The first meeting will be held in December of this year under the Viceroy's presidency, and we wish all success to the new society.

Railway Electrification.

The new conditions arising from the Ministry of Transport Act and the Electricity Bill, when it becomes an Act, obviously affect the use of electricity by railways, both for traction, for power, and for lighting. Electrical development on railways

there is bound to be, and it is of importance to everybody that such work should be carried out and maintained by electrical engineers of standing in the profession. No engineer ought to be responsible in fact for carrying out work involving many hundreds of thousands or even millions of pounds, unless he is also responsible in title. The man responsible for the design and maintenance of railway electrical work must be a first-class man, and no first-class man will long be content to be a subordinate in another department. It is to be hoped that every railway carrying out important electrification schemes will, if it has not done so already, create an electrical department for the purpose.

Sir John Aspinall a year ago expressed the view that the structure gauge should be increased throughout the country at the national cost. Should this matter be undertaken by the Ministry of Transport it is hoped that provision for the overhead equipment of railways for electric traction will not be overlooked.

A matter of great importance is the decision under the Ministry of Transport Act to acquire traders' wagons, which roughly form half of the 1,250,000 wagons in use on our railways. Draw gear is supposed to be tested to 50 tons, and to be worked at 12½ tons, and to be maintained at that strength, but the frequent breaking of couplings at much lower draw-bar pulls shows that this is not done. If heavier goods trains and especially mineral trains are to be hauled by electric locomotives at increased speeds, the strength of the draw gear on all wagons must be increased and maintained at that increased strength, while continuous brakes must be fitted to the fast mineral trains, which is obviously not a requirement that could have been imposed on the trader owners.

Within the limitations of the present structure gauges and the strength of bridges the greatest dimensions of the steam locomotive which determine hauling capacity have been reached, but that capacity on at least one railway amounts on the level to a 1,600-ton load (inclusive of wagon weight) at a high speed. If consisting of 10- or 12-ton wagons such a load would be formed by about 100 wagons and the train would exceed one-third of a mile in length. Should the structure gauge be increased, the power of the steam locomotive could also be increased and the limitation of weight of train which could be hauled would be more emphatically than it is now the strength of the wagon drawgear and not the capacity of the steam locomotive, which has only reached its limit on gradients.

There is a further limitation to the maximum length of mineral or goods train which can be hauled in the length of lay-by and reception sidings. Many of these are made for only 60 or at most 80 wagons, and it is earnestly to be hoped that in laying out new reception sidings and especially "hump yards," where the sorting of wagons is done by gravity, the importance of accommodating trains of at least 100 wagons or more in length will be recognised, if the electrification of goods lines is to be profitable.

Only some of the conditions at present limiting the use of long and heavy goods and mineral trains at high speeds have been briefly stated. Small-capacity coal wagons limit the train load very greatly, but where wagons have to pass under a coal screen in order to load, very few collieries in the country have screens high enough to take more than the 10- or 12-ton wagon.

Enough has been said to suggest that in this country, unlike the United States, many things have to be changed before electric traction can assert its full advantage in hauling heavier goods trains, though increased speeds could be obtained at once. And these changes will take years to carry out.

If, then, mineral and goods traffic is to be hauled electrically under present conditions of size of wagon, strength of draw gear and capacity of sidings, it must be because it is more economical in the cost of haulage, and the same applies to passenger traffic which is without these limitations.

There is, however, an exception to be made to the above statement in the case of mineral traffic down valleys where gradients are steep. This is the case of the Shildon and Newport mineral line electrified by the North-Eastern Railway.

In such cases the maximum hauling capacity of the steam locomotive is not sufficient, since the train of full wagons which came down the grade may have to be divided into two or even three trains of empties before these can be taken up the grade. The saving in locomotives, in locomotive crews, and in time far exceeds any saving in cost of haulage, and railways may confidently embark on the electrification of mineral lines with steep gradients even when electricity is not cheap.

The steam locomotive which can haul 1,600 tons on the level cannot haul one-third of this load up a gradient of 1 in 50 at a convenient speed, while within the same load gauge an electric locomotive can be made to haul the 1,600 tons up 1 in 50, or if need be double this load, provided the draw-gear is strong enough.

Electrical engineers and others not engaged on railways are at times liable to forget that railways are not run by the engineering but by the traffic department. The traffic department has gradually built up its requirements to suit the needs of the travelling public and the trader, and it is those requirements that the engineer has to meet.

In many directions electric traction provides entirely new possibilities which the traffic department has yet fully to realise. To make use of these new methods the traffic department has first to adapt its ideas and habits to the changed conditions and next to carry the travelling public and the trader with it. No small measure of imagination is required by a railwayman to grasp quite new conditions of service and to do so with the enthusiasm of the propagandist.

In discussing the economics of electric traction on railways I propose to consider only the locomotive and the train it hauls, to analyse its running costs with steam, and to see if electricity can introduce such economies in working costs as to warrant its use. Until the new possibilities with electric traction are understood and gradually adopted no appreciable alteration to traffic costs is to be expected, and in the following analysis traffic costs will be taken as unaltered.

Consider the question of superseding the steam locomotive by the electric locomotive both for passenger and for goods services throughout the railways of Great Britain.

When supplied by electricity from central stations using modern large turbo-alternators enjoying such diversity of load that the power factor is above 90 per cent., the coal burnt in the furnaces of the boilers to produce a given hauling effect on the railway by means of an electric locomotive is at most 40 per cent. of the coal burnt in the furnace of a steam locomotive to achieve the same result. To a nation which has largely paid for its imported food by its exported coal and has built up all its manufactures and most of its trade on the foundation of cheap coal, I need not remind you, now that coal has ceased to be cheap, how important the saving on the railways of between 7 and 8 million tons of coal each year would be could it be achieved.

It has been roughly estimated that to electrify all the railways in Great Britain would cost some £300,000,000, and if coal ever rose to 45s. per ton the saving of 7,000,000 tons per annum would of itself pay 5 per cent. on the investment.

The last statistics published by the railways under the Railway Accounts and Returns Act, 1911, were for 1913. If in these returns the working costs per steam locomotive are compared for several large railways running more than 12,000 passenger, goods, and mineral train-miles for each mile of route over which the locomotives of each railway work, it is found that these costs are very similar. Average costs for one typical main-line railway are therefore a rough indication of the costs for the others. They may, however, be quite misleading for railways whose traffic is mainly passenger or for railways where goods or mineral traffic largely predominate.

The figures in the analysis which follows have little intrinsic value in themselves but indicate tendencies, and that is all that is claimed for them.

On the typical railway chosen there are roughly 50 per cent. more passenger-train miles than goods-train miles run and twice as many goods locomotives as passenger locomotives used to run them.

The cost of running a passenger locomotive in 1913 averaged over the year and the railway was £1,240. Of this amount superintendence; lubricants, small stores and miscellaneous; repairs, renewals and depreciation; together with interest at 5 per cent. on the cost of the locomotive amounted to £780, and coal and water to £460, which is 37½ per cent. of the whole.

The average number of passenger-train miles hauled by each locomotive per annum was 27,000; the cost per train-mile for coal and water was 4d. and for the other items 7d., making a total per train-mile of 11d.

The cost of running a goods locomotive in 1913 averaged over the year and the railway was £1,020. Of this amount superintendence, lubricants, small stores and miscellaneous, repairs, renewals and depreciation, together with interest at 5 per cent. on the cost of the locomotive, amounted to £770, and coal and water to £250, which is 24½ per cent. of the whole.

The average number of goods-train miles hauled by each locomotive per annum was 10,000; the cost per train-mile for coal and water was 6d. and for the other items 1s. 7d., making a total per train-mile of 2s. 0½d.

During the present year the cost of coal has increased by 148 per cent., and all the other items making up the working costs, except interest, have been increased by percentages ranging from 120 to 212, so that now the working cost of the train-mile for passenger service is 2s. and the working cost of the train-mile for goods and mineral service is 4s. 8d.

Experience in America and elsewhere has shown that the annual passenger train-miles per locomotive would be increased from 27,000 with steam to at least 40,000 with electricity, and the annual goods train-miles per locomotive would be increased from 10,000 to at least 20,000. Taking these minimum increases and assuming also that the total of all the working costs other than coal and water were the same as for steam, which is not in favour of the electric locomotive, these items come to 10d. for the electric locomotive passenger-train mile and to 1s. 8d. for electric locomotive goods-train mile.

Subtracting these costs from the total steam-train mile costs of 2s. and 4s. 8d. respectively for passenger and goods service, there is left, per electric locomotive train-mile, 1s. 2d. for passenger service and 3s. for goods service to pay for electricity, and also to pay interest on the cost of the electric locomotives and of the electrical equipment—substations, the track conductors, station switches, and bonding of the rails.

Considering first the interest on the capital required for

electrical equipment, Mr. F. W. Carter in a recent communication to the Press* estimates that with high pressure direct-current equipment the cost of electrifying a railway where, as in Great Britain, there is on the average one steam locomotive per mile of route (wihch is the case for the type of railway considered) is approximately double the cost of the electric locomotives required. He also states that the cost of an electric locomotive is 2½ times the cost of the steam locomotive for equal draw-bar pull and speed.

The average capital cost this year of a steam locomotive may be taken as £7,000, so that for each electric locomotive required on the railway its capital cost, together with that of the electrical equipment of the line exclusive of power house and high-pressure transmission will to-day be some £35,000.

In that figure no credit has been taken for displaced steam locomotives, nor on the other hand does it include anything for structural alterations which it has been already urged should be made at the cost of the State, since much larger interests than electrification are involved.

If the revenue earned by the train mileage hauled by each electric locomotive has to pay interest at 5 per cent. on the capital cost of the equipment, then each passenger locomotive hauling 40,000 train-miles per annum must earn 10½d. per train-mile and each goods locomotive hauling 20,000 train-miles per annum must earn 1s. 9d. per train-mile to pay interest on electrical equipment including locomotives.

The earnings for both interest and electricity were per passenger-train mile 1s. 2d. and per goods-train mile 3s., consequently each passenger electric locomotive has 3½d. and each goods electric locomotive has 1s. 3d. left per train-mile for electricity.

I shall show later on that where in this country railways generate their own electricity the annual one-hour load factor (*i.e.*, the maximum load averaged over one hour) does not exceed 40 per cent. except in one special and unique instance. If, however, railways can obtain electricity from power stations with great diversity of load reaching a maximum value of not less than 50,000 KW., it may be possible to generate with a load factor of about 50 per cent., and under these conditions even at recent prices electricity for traction should be able to be bought for ½d. per KW.-hour at the generating station.

At this price the 3½d. and 1s. 3d. available respectively per passenger and goods electric locomotive will provide 7 KW.-hours per passenger-train mile and 30 KW.-hours per goods-train mile.

Assuming 40 watt-hours per ton-mile as an average for passenger service, the average weight of passenger train including the locomotive would be only 175 tons.

Assuming 30 watt-hours per ton-mile as an average for goods service, the average weight of goods train including the locomotive would be 1,000 tons.

The assumptions made in this analysis are numerous and doubtless controversial, but for the type of railway taken they are the same for the passenger and for the goods electric locomotive with the exception of the annual train-miles worked, for which we must go abroad for our figures. It is for the traffic department to say what average weight of train would be required to be hauled by an electric locomotive, but in order to earn the present revenue per train-mile the average passenger train including its locomotive should be more nearly 275 than 175 tons, while the goods train of 1,000 tons is, of course, much heavier than is hauled in this country as an average.

(To be continued.)

CORRESPONDENCE.

Letters received by us after 5 P.M. on TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The New Standards for Cables.

It is to be hoped that the interesting letter from Mr. G. J. Smith in your current issue will do something towards drawing attention to the effects of the new C.M.A. departure.

Probably few will realise until too late the consequences of these heavy increases in prices which, without the slightest word of warning in the letters covering the new lists, are now imposed on us in so smug a manner, camouflaged with an avalanche of literature so voluminous (with four addresses I have had seven copies of an expensively produced list from one firm alone) that the old standard gauge of waste-paper basket must now be replaced by one of size 0.0×00×0 (please refer to "Table of Comparison of Sizes.")

It will be surprising if the members of the E.C.A., bound as they are to C.M.A. makers, will submit to the prices for wires and cables, which were already considerably higher than those of outside high-class manufacturers, whilst there is, so far at any rate, not the slightest intimation that the outside firms are following suit.

If the C.M.A. really had the interests of the trade at heart they would have divided some of their excess profits amongst their customers by keeping cost prices down, instead of squandering them in the printing trade on a lot of useless and inconvenient books, letters, pamphlets, &c. (with numerous promises of more to come, alas!) when a single copy to each dealer, sent from the secretary, would have been ample.

In conclusion, let me ask the C.M.A. two questions:—

1. Have they agreed with the I.E.E. as to which size must now be used as a minimum instead of the ever-popular 1-18?

2. Have they tried to instruct the average wireman or his mate how to select from stock a coil of 3/.036 as distinct from a coil of 3/.029?

Contractor.

November 8th, 1919.

The Employer, the Staff Engineer, and Labour.

In reference to the article on the attitude of the employer to the staff engineer, and its effect on labour, I think the staff engineers are more or less themselves to blame. While working at a central station of the "Ann Assette" type, when the Diesel had not lost the air, and was not trying to run on tar oil, I would get into conversation with the 35s. per week engineer-in-charge on the question of his wages, so as to make things better for his poorer confrères, also the under-dog; the tradesman's son type would remark that his people ran the general post office, or the hotel, at some one-horse village, and that he did not rely on the job for a living; the university student type would merely say that his old man had got pots of it, or make some similar remark. Now, I suppose, they belong to the "new poor," but are only too eager to do blackleg work in the event of trouble, with the result that labour is up against them all the time. As regards the ultra-socialist leaders in trade unions I think you will find their views are entirely different to the rules of the union they represent; this fact seems to be overlooked by the average trade unionist, who cares not whether he is working for a capitalist employer or otherwise provided he is getting trade union rates and conditions. I have been expecting to see some comment on recent advertisements, but this week's Engineer-in-Chief, at 48 hours, seems to be the limit. Would all the engineers-in-chief rush to join the E.P.E.A.?—not when they saw the salary. I must consider myself well off as a shift dog.

Employé.

London, *November 17th*, 1919.

["Engineer-in-Chief" was a printer's error for "engineer-in-charge": the correct form appears in this issue.—EDS. ELEC. REV.]

Electric Soldering Irons.

With reference to the photograph which is shown in the present week's issue of the defective electric soldering iron, it may be of interest to your readers to add some further particulars.

The screw at the end is badly burnt, as was also the thread on the inside of the bit. There was, therefore, practically no reliable contact between the screw end and the bit, and although the screw might be practically red hot, the bit would be comparatively cold.

All the soldering irons in use went the same way after a time, and there was everlasting trouble with the elements burning out, as they became too hot owing to the fact that they were not getting rid of their heat quickly enough.

A user of the irons recently returned to the makers the umpteenth element, which had broken down. In spite of the fact that the causes of the trouble had been placed before them over and over again, the makers wrote back to the user and said they could not understand why the elements broke down. They are experimenting to see if they cannot get a better element!

It seems impossible to get the firm in question to understand the extremely simple fact that the element is bound to overheat if it has not suitable means of parting with its heat to the tip of the soldering iron, and further that the heat cannot possibly flow if the bit is screwed on to the burnt and worn screw.

Apparently the makers are afraid that it would cost an extra 5s. to make the soldering iron on rational lines. Seeing that each breakdown costs something over £1 for repairs, packing, carriage and loss of time, this argument does not appear to be very serious.

One can only hope that someone will put a practical iron on the market, and that we will not have to wait until the Germans are able to begin exporting once again.

Electricity Works, North Shields. **C. Turnbull.**
November 17th, 1919.

An Octaval Rule.

Let me tender my appreciation of your fairminded notice of my little rule, considering that you are frankly all for decimals, a point I am not at the moment wrangling about.

But why not also improve micrometers, if only "temporarily as a palliative," so long as the majority of British and American engineers (in their obstinacy) prefer binary to decimal divisions and inches to centimetres when they have free selection, as both are equally legal British standards.

*F. W. Carter: "Electrification of British Railways," *Electrical Review*, 1919, vol. 85, pp. 68 and 121.

I have before me the usual decimal micrometer, and also one of my octaval pattern, and I want to measure with each 15-32 in. It is a common want, as is proved by the makers of the decimal "mike" stamping its decimal equivalent .4687 on the bar of the instrument. This is the performance: I open the screw until 4 is indicated on the first scale; then I have to take the next two figures together, and having mentally estimated how many 25's (two) are in the 68 I open to two subdivisions of the first scale. Then I deduct this 50 from the 68, and open the screw until 18 is read on the thimble divisions. But there still remains the final 7, and I have to open a shade more until this figure is indicated by the vernier method on a third scale. It's so simple!

I pick up the octaval micrometer, find stamped on the bar that 15-32 in. is equal to .32, open the screw until 3 is indicated on the first scale, then open more until 2 is indicated on the thimble divisions, and—that's all.

Which of the two methods is the nightmare? I grant that when the present user of "our impracticable system of measuring in vulgar fractions" joins the upper ten and measures in tenths, &c., he will not want octavals. But—happy thought—his present favourites are no longer vulgar when expressed in octavals.

Alfred Watkins.

Hereford, *November 17th*, 1919.

[*Do* British engineers prefer binary divisions? The mil is in universal use, and the British Engineering Standard Specifications are almost wholly expressed in decimals of an inch. Our plebiscite in 1915 gave a verdict of 4 to 1 in favour of the adoption of the metric system. Dimensions that are stated in vulgar fractions are never expected to be worked to accurately; the practical workshop equivalent of 15/32 is 0.47, and to carry the measurement to the ten-thousandth of an inch in such a case would be folly. If Mr. Watkins's octaval micrometer does not read to the same degree of accuracy, it is quite unfair to make the comparison he gives above. At least half the opposition to the metric system is due to general ignorance of the meaning of "significant figures."—Eds. Elec. Rev.]

THE ELECTRICITY SUPPLY BILL.

On Tuesday, November 11th, Standing Committee B of the House of Commons discussed Clause 24 (supply of apparatus); an attempt to enable District Boards to sell and hire-purchase electrical apparatus was defeated by 13 to 8, and an amendment was accepted ensuring the purchase of appliances belonging to supply authorities on consumers' premises. The clause was passed as amended, and Clause 25 (limitation of prices and profits) was taken. An amendment was made leaving the prices subject only to the approval of the Electricity Commissioners, and the clause was passed.

Clause 26 (alteration of type of current, &c.) was amended so that it should not apply to railway power stations, and passed. Clause 27 (substitution of special for provisional orders) was amended to conform with the new Clause 5, and passed.

On November 12th, the Committee passed Clauses 28 and 29, and amended Clause 30 (power of boards to borrow) to prevent the extension of loan periods on the ground of high cost of labour or materials. The clause was passed, together with other financial clauses, Nos. 31 to 35.

Clause 36 (application of the Conspiracy Act) was challenged on the ground that it took away the right of employés to strike, but the Home Secretary explained that it only affected a strike without notice, and the clause was adopted by 18 to 3. Clauses 37 to 43 were amended and passed, but Clause 44 (transfer of powers to the Minister of Ways and Communications) was rejected by 24 to 4. Clause 45 was passed, and on November 13th new clauses were added to the Bill, and the Bill as amended was reported to the House.

Electric Vehicles in New Zealand.—The New Zealand Express Co., of Dunedin, in November, 1917, replaced a 2½-ton petrol lorry with a 2½-ton Orwell electric, manufactured by Messrs. Ransomes, Sims & Jefferies, Ltd., of Ipswich, and fitted with the Chloride Electrical Storage Co.'s Ironclad-Exide battery. This being the first commercial electric vehicle in Dunedin, it was considered by many that it would be unsuitable, Dunedin being looked upon as one of the hilliest cities in the southern hemisphere. The results obtained during the 18 months it has been in service have been most satisfactory, and three more vehicles, each of 3½-ton capacity, are shortly to be put on the roads. Records kept during the first nine months show the following results:—Days vehicle in use, 220; days out of commission, 57; miles run, 2,850; ampere-hours discharge, 23,950; ampere-hours charge, 28,490. The 57 days out of commission included Sundays, holidays and the sickness of the driver. The above figures show that the cost of electricity per mile run, based on the rate of 1d. per unit, the usual rate for night charging, was approximately 4d. The repair bill for the three months was 3s. 11d.—*Commonwealth Engineer.*

BUSINESS NOTES.

Import and Export Licences.—The Board of Trade announces that the Export Licence Department has now removed from 1, Queen Anne's Gate Buildings, S.W. 1, and has been amalgamated with the Department of Import Restrictions at 22, Carlisle Place, S.W. 1. The combined Department will be under the charge of the Assistant Secretary, Industries and Manufactures Department, Board of Trade. Applications for licences in respect of all commodities (with the exception of dyestuffs and coal), and all inquiries relating thereto, should be addressed to the Director, Imports and Exports Licensing Section, Board of Trade, 22, Carlisle Place, S.W. 1 (T.N., 4173 Victoria).

Plant for Disposal.—St. Helens Corporation Electricity Committee offers for sale one Willans-Dick, Kerr 500-kw. set, one Willans-Mather & Platt 200-kw. set, and two Wheeler surface condensers. For further particulars see our advertisement pages to-day.

The F.B.I.—The following appointments were made at the annual meeting of the Federation of British Industries, on November 12th. Sir Vincent Caillard relinquished his position as president on the termination of his year of office:—President, Mr. W. Peter Rylands (Rylands Bros., Ltd. Warrington); vice-presidents, Mr. Godfrey Isaacs (Marconi's Wireless Telegraph Co., Ltd.); Mr. Philip Lockhart (W. & A. Bates, Ltd., Leicester); Sir William Pearce, M.P. (Association of British Chemical Manufacturers).

Charge of Lamp Stealing.—At Leeds, a former manager of the Barnbow filling factory, named Joseph Huxley Hopkins, was on November 11th, committed for trial at the Assizes on a charge of stealing electric lamps belonging to the Government. It was stated that Hopkins's salary was £600 per year. He was accused of selling some 2,000 lamps for £150, which he received by cheque, and afterwards using the money for his own purpose. Bail was fixed at £500. Hopkins reserved his defence.

Trade with Poland.—We have received from the Warsaw Company for Trade and Navigation, Ltd., of 1-4, Bury Street, London, E.C. 3, a copy of a circular-letter issued by their head office in Warsaw, announcing the opening of branches in London and Liverpool. They own steamers operating on the Vistula, and possess facilities for the forwarding of general merchanise to or from Danzig and all parts of Poland. Special arrangements have been made with various steamship companies sailing from British ports to Danzig, and they desire to do everything possible to help in establishing trade relations between firms in this country and those in Poland.

Lead.—Messrs. James Forster & Co. report:—

We have again to record a large turnover in lead, the majority of transactions being for shipment well ahead. The sales on the open market have averaged well over 1,000 tons daily, and values have risen fully 15s. per ton over last week's close. Quotations at the close of November 15th were approximately £31 10s. for November and December shipment, £34 12s. 6d. January and February, and £34 17s. 6d. for March, with rather sellers at these prices. The general position is, however, too strong to admit of any possibility of a serious decline in values for some time to come, and a steady market at round about the present figure, may be fairly anticipated.

Messrs. G. Cawson & Co. in their report, say:—

The Government have sold further moderate quantities at full prices. Stocks decreased last month by 8,728 tons, and the total now is reported to be 64,832 tons. This figure is somewhat misleading as the total unsold stock cannot now be more than 25,000 tons even if it is as much. The price of lead appears to us to have been pushed up too rapidly—the average price for the three years previous to the war was about £15 per ton, and this was supposed to be a good paying figure for producers. We have now an advance of about 130 per cent. in lead, and a similar advance in silver, which must surely largely stimulate production all over the world. The high price so far has not seriously influenced consumption unfavourably. There has again been a fair demand for electrical purposes, although ordinary consumption is rather slack. . . . The outlook, unless supplies increase, points to a continued firm market, although this position may change at any time should speculators decide to realise.

Free Electrical Imports and the State.—The *Morning Post* says that Mr. D. N. Dunlop, director and secretary of the B.E.A.M.A., addressed, on October 21st, to Mr. Lloyd George a long letter on the subject of free imports and the State. "With whatever necessary safeguards, with whatever qualifications, an Industries Board is necessary," Mr. Dunlop said, "and my Council earnestly ask you to consider its formation at the present turning point in the life of the nation." Mr. Dunlop's letter was, on October 24th, formally acknowledged. He has, therefore, written to the Prime Minister asking for an answer.

The Government Anti-Dumping Bill.—This Bill, to prevent the dumping of goods from abroad at prices under the cost of manufacture, was to be presented in the House of Commons on Wednesday by Sir Auckland Geddes.

Fire at Submersible Motors.—On Saturday afternoon last, at 3 p.m., fire broke out in the works of the Submersible Motors, Ltd., Southall. The machine shop and drawing office were burnt out, but the fitting and assembly shops, the stores, and the rest of the offices were saved. Arrangements were at once made to equip a temporary winding shop and brass shop, and it was hoped that they would be running by this week-end. The company requests its numerous customers to extend their sympathetic consideration to it under these circumstances, and hopes to resume deliveries with little delay.

Italian Electrical Companies.—The Società Mineraria ed Elettrica del Valdarno, of Florence, has been recently in deliberation on the increase of its capital from 30,000,000 to 50,000,000 lire, and with the Società Toscana per Imprese Elettriche, the Lignitì d'Italia, and the Miniere Carbonifere del Baccinello, all of which are to be incorporated in the first-named company.

The following companies have augmented their capital:—Elettrica del Barman, from 600,000 to 1,000,000 lire; Elettrica Comense A. Volta, from 6,000,000 to 8,000,000 lire; Generale Elettrica del l'Adamello, from 30,000,000 to 50,000,000 lire; Industriale Italiana (Rome), from 12,000,000 to 24,000,000 lire; Impranti Elettrici del Boite (Venice), from 600,000 to 5,000,000 lire; Bellanese per l'Industria Elettrica (Venice), from 240,000 to 1,240,000 lire; Elettrica Calabro Tirrena (Paola), from 150,000 to 1,000,000 lire; Telefonica Cisalprina (Bergamo), from 750,000 to to 1,000,000 lire; the Officine Elettromeccaniche Bolognesi (Bologna), from 160,000 to 800,000 lire; Società Industrie Telefoniche Doglio (Milan), from 5,000,000 to 6,000,000 lire; and the Società Italiana per Conduttori Elettrici Isolati e Prodotti affini (Leghorn), present capital of 3,500,000 lire to be shortly raised to figure not stated.

At Piacenza has been formed a company, under the style of Società Elettrica ed Industriale di Valdarsa, with a capital of 800,000 lire, for the construction of hydro-electric stations and the distribution of electric energy.

The Unione Industriale fra Consumatori Energia Elettrica is the name of a company which has been established at Treviso, with a capital of 500,000 lire, apparently as a co-operative electric supply concern.

For the manufacture of the heating patents of Amleto Selvatico there has been formed, at Milan, the Società Anonima Fabbrica Apparecchi Riscaldamento Elettrico Brevetti Amleto Selvatico, with a capital of 2,500,000 lire.

The Officine Elettro Meccanica Alfredo Ghieri e Ca. has been established as a company, with a capital of 150,000 lire. Its headquarters are at Florence.

The firm of Pellegrini Rubini e Ca. has been converted into a company, under the style of Impresa Elettrica di Riccione, with a capital of 236,000 lire, with the same objects of supplying current to the Commune of Riccione and its neighbourhood.

The Società Elettrica Ligure Picena, of Rome (capital 2,750,000 lire), has been incorporated into the Società Industriale Italiana.

Steel Trade Developments.—The *Financial Times* states that the recent acquisition by the Berry group of JOHN LYSAGHT, LTD.—a deal involving about £5,000,000—has been followed by a further development, Lysaght's having purchased a controlling interest in Joseph Sankey & Sons, Ltd., for between £400,000 and £500,000. The specialities of Joseph Sankey & Sons include the rolling of high qualities of steel sheets, stampings for the electrical and engineering trades, the manufacture of hardware and enamel ware, motor accessories and steel motor wheels.

Book Notices.—Technical Paper of the Bureau of Standards No. 343, entitled "Location of Flaws in Rifle-barrel Steel by Magnetic Analysis," and describing an investigation which was undertaken for the purpose of determining whether an application of magnetic analysis was practicable for the detection of flaws in rifle-barrel steel. By means of an apparatus especially constructed for the purpose, a large number of bars were explored for magnetic uniformity along their length. The results demonstrated that the method was amply sensitive to detect and locate flaws. Further study is necessary to determine to what degree the sensitivity should be reduced in order not to cause the rejection of material which is satisfactory for all practical purposes, and also to determine the type and magnitude of the effect which will be produced by a pipe. The investigation is being continued by the Winchester Repeating Arms Co.

Technical Paper of the Bureau of Standards No. 344, on "Spectral Photoelectric Sensitivity of Silver Sulphide and Several Other Substances." Data are given on the change in the electrical resistance of the sulphide of silver and of bismuth when exposed to radiations of wave-lengths extending from 0·6 μ to 3 μ. Measurements were made also on galena, cylindrite, pyrites, and jamesonite. The effects of temperature, of the intensity of the exciting light, and of mechanical working upon photoelectrical sensitivity of silver sulphide were investigated. Washington, U.S.A.: Government Printing Office.

We have received a handsome brochure, entitled "The Heart of a Car is the Engine," published by Messrs. Dormans, of Stafford, motor engine specialists. The reading matter, which is handsomely illustrated, and describes not only the manufactured engine, but also the various processes of its production, was compiled by an independent writer, who expresses his own opinions in his own way. We have also received a booklet containing recent Press comments on the achievements of Messrs. Dormans.

We have received a copy of the first number of the new quarterly series of "Abstracts of Papers in Scientific Transactions and Periodicals," published by the Institution of Civil Engineers. This is quite distinct from the "Minutes of *Proceedings*," and it is anticipated that the abstracts will be available more promptly. The book is well indexed with both name and subject indexes—which will both also be printed in "Minutes of *Proceedings*." Several of the abstracts are illustrated, and the book will, no doubt, be welcomed by many engineers, as it is intended to publish abstracts from papers and periodicals read and published in all parts of the world.

The *Radio Review* is a new monthly periodical (Wireless Press, price 2s. 6d.) recording scientific progress in radiotelegraphy and radiotelephony; it is edited by Prof. G. W. O. Howe, D.Sc., M.I.E.E., assisted by Mr. Philip R. Coursey, B.Sc., A.M.I.E.E., and may, therefore, be relied upon to take a place in the front rank of "wireless" literature. The first issue contains articles by Prof. A. Blondel and Prof. W. H. Eccles, and an explanation of the objects of the new journal by the editor. The contents will cover a wide field, including the physical and mathematical side of the subject, as well as electrical and mechanical problems, and a review of the literature of radiotelegraphy will be given.

Lamp Bulb Guide for Car Lighting. Pp. 48, 29 figs. London: B.T.H. Co.—Perhaps the most striking development in the accessory equipment of the motor-car is the complete way in which electric lighting has ousted the acetylene burner. Practically every car exhibited at the Motor Show, even the cheapest, was equipped for electric lighting. A difficulty encountered by buyers of motor-car lamp bulbs is the lack of standardisation in car-lighting equipment. Differences in voltage, type of lamp-holder, total watts, &c., tend to complicate the purchase of lamp bulbs. The publication of a new and up-to-date edition of this guide will be welcomed by all motor traders, because it contains, in concise and easily-accessible form, all the information required by the purchaser of lamp bulbs. This information includes full data regarding the voltage, watts, amperes, bulb dimensions, and prices of the various types of Mazda lamp bulbs for head, side, tail, and dashlights and interior lights, and similar data on motor-bus bulbs, hand lamps, and flashlight bulbs. A useful feature is the set of tables which fills the second half of this booklet. This tabulation is an alphabetical list of all cars and motor cycles, British, American, and Continental, on sale in this country, giving for each car the following particulars:—Model of car, type of lamp cap, volts, watts, and amperes of head, side, and tail-lights, which information, so far as is known, is not available in any other publication. Other useful features are the dimensioned diagrams of the various lamp caps available; a diagram showing the inch equivalents of millimetre measurements (all bulb and cap dimensions are given in millimetres); and a copious subject index. Although Mazda lamp bulbs are naturally given due prominence, the booklet is something more than a mere trade pamphlet, and deserves to be preserved for constant reference.

The British Westinghouse Gazette. Vol. V. No. 78. September, 1919. This issue might be called a lighting number, inasmuch as it contains editorial articles on industrial lighting and the manufacture of the Cosmos electric lamp. The effect of efficient lighting in industrial workshops is next dealt with, and the effect of interior colours and finishes upon the lighting of rooms is also considered.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVIII. No. 10. October, 1919. New York: The Institute. Price $1.

Researches of the Electrotechnical Laboratory No. 78. "Telephonic Transmission of Superimposed Circuits." Tokio (Japan): Department of Communications.

"Science Abstracts." No. 262. Sections A and B. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each.

"Costruzioni Elettromeccaniche." By E. Morelli. Second edition. Vol. I. Pp. iv + 824; 724 figs. and 33 tables. Vol. II. Parts 2 to 5. Pp. iv + 764; 805 figs. and 25 tables. Milan: Unione Tipografico-Editrice Turinese. Price 40 lire per vol. net.

Efficiency Exhibition.—It is announced that the *Daily Mail* proposes to hold an Efficiency Exhibition at Olympia in February, 1920. It is intended that every machine, method, or system, that can save labour, time, and materials, shall be represented. The demonstrations will cover the farm, the counting house, the factory, the office, and the warehouse. Support has already been promised by a number of organisations interested in the matter, including the Federation of British Industries, the British Science Guild, and the Electrical Development Association. Inquiries should be addressed to the Organising Secretary, Efficiency Exhibition, 130, Fleet Street, London, E.C. 4.

German Transmarine Electricity Co.—The Protective Committee for South America, formed by the Swiss Bankers' Association, have requested Swiss owners of ordinary and preference shares and debentures in the Deutsch-Ueberseeische Elektrizitäts Gesellschaft, of Berlin, to notify their holdings to a Swiss bank by November 25th. The object is to protect the interests of the Swiss proprietors.

Register of Male Employés.—The Minister of Munitions has revoked Notice MM 37A, requiring establishments to keep up to date a register of all male employés over 16 years of age.

Dissolutions and Liquidations.—A. T. WALMISLEY AND WHITE, civil engineers, 9, Victoria Street, S.W.—Mr. A. T. Walmisley and Mr. S. H. White have dissolved partnership. Mr. S. H. White will attend to debts and continue the business.

J. JONES & Co., electrical and mechanical engineers, 18, Canal Street, Nottingham.—Messrs. J. Jones and W. Mason have dissolved partnership. Mr. Jones will attend to debts.

Under the compulsory liquidation of CONNOLLY BROS., LTD., Blackley Vale Mills, Manchester, particulars of which appeared in our last issue, the statutory meetings of the creditors and shareholders were held on November 13th, at the Board of Trade Offices, Carey Street, Lincoln's Inn Fields, W.C. Mr. W. J. Warley, Official Receiver, presided. A resolution was passed for Mr. J. Macdonald Henderson, chartered accountant, 2, Moorgate Street Chambers, E.C., to act as liquidator.

The English Electric Co., Ltd., and Siemens Bros.—We are informed that the English Electric Co., Ltd., have bought the Siemens works at Stafford. This marks a further important stage in the development of the policy of the English Electric Co., which, as formed early in the year, represents the consolidation of the interests of Dick Kerr, the Coventry Ordnance Works, Willans & Robinson, and Phœnix Dynamo. The comprehensive scheme of the amalgamation aims at not only the ability to undertake contracts of any magnitude or description in world-wide competition, but scientific sectionalising of the various manufactures of the group with a view to the maximum efficiency in production at the several works in Preston, Coventry, Bradford, Scotstoun, Rugby, and now Stafford. A working agreement has been entered into between the English Electric Co. and Siemens Brothers & Co., providing for the preferential exchange of the special products of each. Thus both companies benefit, as both now command the supply of greater variety of manufacture than hitherto.

From the Foreign Press.—The following items are selected from the first number of the *Economic Review* dated November 12th (1s. weekly). This *Review* is the economic section of the Review of the Foreign Press, which the Government decided it could not afford to continue, but which is to be published as a public service on a self-supporting, though not a profit-making, basis.

Electrical Companies Amalgamate.—The *D.A.Z.* (Oct. 1 e) learns that the taking over of the Auer Co.'s incandescent lamp factory by the A.E.G. is likely to be followed by further amalgamations in the industry in question.

Czecho-Slovakia.—The Prague Electricity Co., with the assistance of four banks, is erecting a factory for the manufacture of incandescent lamps with a view to eliminating the import from Germany of such lamps. Manufacture is to be increased so that export will be possible.—(*Der Welthandel, October 3rd*).

Poland.—A joint-stock company, capital Mk. 2. mill., has been founded in Warsaw to promote electrical undertakings in Poland, to erect engineering workshops, and to organise the trade in electrical apparatus.

Berlin Copper Quotations.—According to a Berlin telegram, the Association for Electrolytic Copper Quotations fixed an official price for electrolytic copper on October 28th for the first time, viz., Mk. 1,535 per 100 kg. In the last few days the price on the open market varied from Mk. 1,500 to Mk. 15,500.—(*F.Z.*, October 29.m.i.)

German Orders from South America.—South American importers are placing large orders with German firms, particularly in the heavy industries. Allowance is made for the uncertain state of production in the times of delivery fixed, and the prices are very satisfactory. Upper Silesian firms have been making extensive business propaganda in South America, and are now beginning to reap the benefit. The Bismarck Smelting Co. has recently received a South American order to the value of Mk. 16 mil. The company is already very busy with other foreign orders. Production continues to improve.—(*Welthandel*, September 19th).

Electricity from the Air.—The Danish scientist, Waldemar Poulsen, is engaged on experiments in connection with the discovery of a method of deriving electricity from the air. He proposes to demonstrate his invention some time next spring. If successful he holds that it will completely revolutionise industry.—(*Trondhjems Adresseavis*, October 24th).

Bankruptcy Proceedings.—Charles Colton, 111, Savoy Court, Strand.—Creditors met at the London Bankruptcy Court on November 10th before Mr. D. Williams, Official Receiver, under this failure, in which a receiving order was made on October 28th at the instance of a creditor. The Chairman reported that it appeared from the debtor's statements that he was an American citizen and an electrical engineer. In 1897 he went into the employment of the Walker Electric Manufacturing Co., of Cleveland, Ohio, which concern was purchased by the Westinghouse Electric Manufacturing Co. in 1899, his serviecs being retained. In the early part of 1902 he left that company and went to Berlin to assist in the organisation of a German electrical manufacturing company. He remained there until December, 1902, when he came to England to take up an appointment as export manager of the British Westinghouse Electric Manufacturing Co., Ltd. That appointment he held until December, 1917, by which time he had saved £5,000; in addition he held an option to purchase an American investment for a ready fastener, which he subsequently sold to Kynoch's, of Birmingham, and received £14,000. In April, 1918, he became interested through the then managing director of Hudson's Consolidated, Ltd., in the Aabada Trust, Ltd., the idea being to utilise the trust for floating electrical and engineering propositions. Offices were taken in September, 1918, at 61, St. James's Street, on behalf of the trust, to which the debtor transferred his share-holding in the Aabada Dry Battery Co, Ltd., together with other of his shares. He became managing director of the Trust, and was to receive 15 per cent. of the net profits. The debtor purchased from Hudson's Consolidated, Ltd., 40,000 of their Aabada Trust shares at 2s. 6d. and sold them to friends at 5s. or 6s. each. The Stock Exchange refused a quotation, with the result that the shares could not be sold to the public. The debtor's friends took up the attitude that they had been let in by him for a bad deal, and he consented to refund them their money, and did so, together with the amount put into the Trust by the petitioning creditor, who promised to keep his shares and make the Trust a success. That gentleman, however, asked the debtor to take up his shares, and the latter agreed to do so, giving in return three promissory notes aggregating £3,100, and payable at 60 and 90 days. The debtor was unable to take up the promissory notes at maturity, and they represented the claim in the petition for the receiving order. He had further stated that altogether, including the amounts returned to his friends, he had put £20,000 into the Trust, which was still carrying on business, although it was not doing much at present. The debtor resigned the post of managing director last September, but expected to be appointed general manager. It also appeared that in December, 1917, the debtor, jointly with a gentleman now in America, acquired an interest in a primary electric battery which they developed, the expenses being shared between them equally. They formed in October, 1918, the Aabada Dry Battery Co., Ltd.; the debtor financed that company to the extent of £750, and, as previously stated, he transferred his holding therein to the Aabada Trust, Ltd., last January. The company had changed its name to the Beta Dry Battery Co., Ltd., and three months ago the debtor resigned his directorship therein. Then about eleven months ago the debtor became managing director of the Comparri Wireless Control Co., Ltd. He agreed to complete the development of a wireless demonstration set, and also an electric piano player. The latter did not prove a commercial success, and the wireless set required for its proper development more attention than the debtor could give to it. He held no shares in that company, but estimated his loss over it at £1,100. No statement of affairs had yet been lodged, but the debtor roughly estimated his liabilities at £9,000, and the value of his assets had yet to be ascertained. He attributed his failure to loss of £5,000 by Stock Exchange speculations and to his losses in connection with the Aabada Trust, Ltd. A resolution was passed for Mr. F. S. Salaman, C.A., to act as trustee and administer the estate in bankruptcy, with the assistance of a committee of inspection, but the Official Receiver promised to delay the application for the order of adjudication to give the debtor an opportunity to submit a proposal for the consideration of the creditors. The bond to be given by the trustee was recommended at £500.

C. Hellyer (A. Parker & Co.), electrical engineer and contractor, 130, Upper Richmond Road, East Sheen.—Application for debtor's discharge will be heard at Wandsworth on December 8th.

Women in the Engineering Trades.—We learn from the *Birmingham Post* that an interesting report, covering information received from 1,422 firms and giving valuable tables and statistics in regard to the employment of women in engineering and other trades, is issued by the Women's Industrial League, which has as its object: "To secure equality of treatment and opportunity for employment of women." The report shows that 79,900 women were employed at the end of May, 1919, as against 245,300 during the war, and the letters received from the firms concerned show that they were highly satisfied with the work of women, and are willing to retain or reinstate them if allowed to do so. Thus:—

> Since the armistice, the A.S.E. has insisted upon our dismissing the women working on armature work, because we were not employing women in the same room or department as formerly. We don't think the decision was a fair one, and we make our protest accordingly, but without avail. . . . We venture to express the opinion that women's work is infinitely better than men's for many branches of our work.
>
> We are more than pleased with the loyalty, cheerfulness, and willing service of the women in our employ. They are unquestionably an example to the male labour, practically without exception.
>
> We intend to keep women as long as allowed, for they have given complete satisfaction and are displacing no men.

A third of the firms who employed women for the first time during the war have been able to retain them on some processes, and a further third would be willing to keep them on, but for the opposition to such a policy. Of the firms which had employed women in pre-war days, 67 propose to increase their number, in view of the greater experience of women's work that they have gained. The report also gives details of new industries open to women since the war, notably aircraft manufacture, in which they have obtained a high standard of efficiency on many processes. Another reason given as a factor militating against the retention of women is the habit of the Government of introducing special legislation to "protect" women workers. The Women's Industrial League is asking for "equality of treatment," which can be the only solution of the problem on economic grounds as well as those of justice.

F.B.I. Commissioner to Scandinavia.—The Federation of British Industries has appointed Mr. Montagu Villiers to act as its Trade Commissioner in the Scandinavian countries. Mr. Villiers has spent many years in the Consular Service, and lately in the commercial diplomatic service. He is well known in Stockholm, Copenhagen and in commercial circles in Norway, and among other positions he held was that of British Consul at Stockholm from 1906 to 1913. He leaves for Scandinavia on Tuesday next, and will make a tour of inspection, returning to England early in January next. He will report as to the economic conditions in Scandinavian countries, and later set up offices in Norway, Sweden and Denmark. He will be accompanied by Mr. John Pitcher, who has made a special study of transport and trade conditions in various countries.

Trade Announcements.—Messrs. I. Frankenburg and Sons, Ltd., state that in connection with their amalgamation with the Irwell and Eastern Rubber Co., Ltd. (see our "New Companies Registered" column in last week's issue), there will be no change in the directorate or management of the two businesses. The new company will have increased capital which will facilitate extensions of buildings and plant, and in consequence output. Debts of both companies will be taken over by the new company—the Greengate and Irwell Rubber Co., Ltd.

Messrs. H. W. Butler & Co., of Craven House, Kingsway, W.C. 2, have been appointed sole agents in this country for the products of the Locke Insulator Manufacturing Co., of Victor, N.Y., manufacturers of all kinds of porcelain insulators for H.T. and E.H.T. control, supply and distribution, and also for all the varied requirements of wireless working. We are informed that a large number of H.T. lines in America, and many in Europe, are supplied with Locke material; also that the Hydro-Electric Power Commission of Ontario has considerably over 1,000 miles of supply lines, about 80 per cent. of which are insulated with Locke porcelain; and that a large part of the American Government wireless stations and Naval wireless stations are equipped with Locke insulators.

Messrs. T. J. Grainger & Co. have removed to 31, Side, Newcastle-on-Tyne. Telephone: "Central 3474."

The C.E.A. Co., Ltd., of Diana Place, Euston Road, N.W., have prepared a special C.E.A. November catalogue, which they will forward to any purchaser on application. They are carrying stocks of electrical accessories for export and other purposes.

Belgium and German Exports.—The Belgian Government has issued an order which throws open the market to a large extent to the imports of German goods. Among the latter are mentioned switches, lamp sockets, batteries, and insulating tubes, magnets, &c.; but lamps, wires, and cables, are excluded. At the same time, German goods intended for oversea countries can again be received in transit-trade at reduced railway rates, and also be cleared without any formality if sent by ship for re-shipment to transmarine countries.

Catalogues and Lists.—Messrs. C. A. Vandervell and Co., Ltd., Warple Way, Acton Vale, London, W. 3.—Illustrated technical booklet dealing with motor-car electric lighting and engine-starting equipment. Illustrated folders C and D, giving particulars and prices of motor-car accumulators.

Messrs. Drake & Gorham, Ltd., 67, Long Acre, London, W.C. 2.—Illustrated priced pamphlet, No. 271, dealing with tungsten lamps, lanterns, and reflectors.

The Overseas Engineering Co., Ltd., 75, Curtain Road, London, E.C.—Illustrated leaflet, No. 57, describing the "Overseas" safety electric water heater.

Messrs. Batteries, Ltd., Redditch. — Illustrated booklet dealing with the NI-FE Jungner system of nickel-iron-alkaline accumulators.

Messrs. Ed. Bennis & Co., Ltd., 28, Victoria Street, London, S.W. 1.—Illustrated revised catalogue dealing with chain-grate mechanical stokers.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C. 4.—Illustrated leaflet specifications Nos. 58 A and 82 A, dealing respectively with "Witton" Star-delta starters and "Witton" auto-transformer starters for starting up squirrel-cage induction motors.

Messrs. Pope's Electric Lamp Co., Ltd., Hythe Road, Willesden, London, N.W. 10.—Illustrated coloured leaflet giving prices of "Pope" Elasta lamps. This will be supplied to contractors and dealers, overprinted with their names and addresses, upon application.

Messrs. Marclen Pumps, Ltd., 25, Victoria Street, London, S.W. 1.—Illustrated booklet dealing with acid pumps.

The Protection of the Italian Telephone Industry.—By Royal decree it is announced that in placing orders for equipment or works for the telephone service, preference will be given, in the first place, to the national industry, by which is understood that the goods are produced in Italy, by means of Italian capital and labour, and using native prime materials. In the second place, preference will be accorded to foreign firms established in Italy manufacturing there the goods required, with a preponderance of native labour, whatever be the source of their capital, and whatever their origin. Merely assembling the parts made abroad will not give a title to the preferences mentioned. Where tenders are invited native firms will enjoy a protection of 10 per cent., and foreign firms producing in Italy a protection of 5 per cent. The decree is to be presented to the Italian Parliament in order to be converted into a law.

Blackburn Electrical Contractors.—An endeavour is being made in Blackburn to resuscitate the local Association of Electrical Contractors. In the past local members have had to travel by train to attend meetings of the district, and it is now thought that the Blackburn area is sufficiently large to have an organisation of its own.

Electric Postal Vans in Milan.—The Minister of Posts and Telegraphs has given a contract for the institution and working of a service of electric accumulator postal vans in Milan, to the newly formed Società Generale Italiana Accumulatori, which company, with a capital of 2,000,000 lire, proposes to extend its field of operations to embrace the principal cities of Italy.

Non-Ferrous Metal Industry Act.—The *London Gazette* for November 18th contains a list of further licences granted under this Act.

Japanese Commercial Commissioners.—H.M. Commercial Secretary at Yokohama writes that official plans are being prepared by the Japanese Government for the establishment of Commercial Commissioners in foreign cities to forward Japanese trading interests. While the Department of Agriculture and Commerce has been able, in the past, to obtain commercial reports from Japanese Consular officials such reports it is stated, have proved of little use for practical purposes. It is, therefore, deemed advisable to establish offices of Japanese Commercial Commissioners in foreign lands to serve Japanese traders in order to expand the country's commercial power throughout the world.—*Board of Trade Journal.*

LIGHTING AND POWER NOTES.

Aldershot.—Loan.—A Ministry of Health inquiry was held last week into the application of the U.D.C. for a loan of £12,750 for electricity purposes. There was no opposition.

Beddington and Wallington. — Extensions. — The County of London E.S. Co. has informed the U.D.C. of its intention to lay mains through the town to a new factory being erected.

Birkdale.—Price Increase.—As from September last the scale of charges will be:—Private houses: Lighting, 8d. per unit; heating, power, &c., 2½d. per unit. Business premises: Lighting, maximum demand system, 8d., 6d., and 4d. per unit, plus 15 per cent.; heating, power, &c., 2½d. per unit; special prices, 5½d. per unit; meter rents, 2s. 6d. per quarter.

Birmingham. — Supply Restrictions. — Owing to shortage of plant, the Corporation requires all new consumers to sign an agreement to use electricity only during specified hours, and to agree to a condition that power may be cut off at any time without notice.

Burley-in-Wharfedale.—Water Power.—An engineer has offered his services to survey the district carefully on a basis of "No cure, no pay," and if, after his investigations, electricity cannot be generated by water power at ½d. per unit, he will forgo his fee. A Committee is considering the offer.

Coxhoe.—Public Lighting.—The East Hetton and Trimdon Grange Collieries are willing to light the streets and roads in East Hetton, Quarrington Hill, Cassop, South View, and Kelloe, by electricity, the colliery company to lay the necessary cables and provide plant for £800 per annum.

Dewsbury.—Inadequate Supply.—Complaint of the inadequate supply of electricity provided by the Corporation Electricity Committee was recently made by local business men at a meeting of the Dewsbury Chamber of Commerce. A member wrote complaining that he could not extend his business owing to the refusal of the Electricity Committee to supply him with power. Mr. F. Rhodes said that arrangements should be made to take power from the Yorkshire E.P. Co. Batley Corporation had already made such arrangements. Alderman Chas. Brooke said that about 40 firms were waiting for a supply of electricity. It was decided that a deputation should wait on the T.C. and urge that power be taken from the Yorkshire E.P. Co.

Doncaster.—New Plant.—The T.C. has decided to install a 2,000-kw. Ljungstrom turbo-generator and a Babcock boiler at the electricity works.

Dover.—Mains Extensions.—It is proposed to supply the South Foreland Lighthouse with electricity from the Corporation mains. This will necessitate the laying of 5,000 yards of cable at an estimated cost of £2,400.

Frome.—Price Increase.—The B. of T. has consented to the E.L. Co. increasing the charge for electricity for lighting to 10d. per unit, but has refused to sanction a minimum quarterly charge.

Grantham.—Price Increase.—The Urban E.S. Co. has notified the T.C. of the following increases, to apply from the quarter ending December next:—An additional 1s. per quarter on meter rents, and on the supply by contract an increase of 2½d. per unit, plus the present percentage.

Hastings.—Loan.—A Ministry of Health inquiry was held on November 11th into the application of the T.C. for a loan of £14,219 for an E.L. scheme. There was no opposition.

Heston and Isleworth.—Loan.—An inquiry has been held by the M. of H. into the Council's application for sanction to borrow £9,640 for the electricity undertaking, and the Inspector expressed satisfaction with the Council's bulk-supply proposal.

Louth. — E.L. Scheme.— The Arota Electrical Co. proposes to install plant, and lay cables for an E.L. supply for the town, and a prov. order is to be applied for.

London.—Stepney.—The B.C. is applying to the L.C.C. for sanction to borrow £116,500 to defray the cost of a turbo-generator and two boilers, which is only part of a proposed scheme. It is estimated that if the whole scheme is completed, it will involve an expenditure of £534,700.

Supply Failure.—For nearly three hours on Tuesday evening certain buildings in Fleet Street were in darkness owing to a temporary failure of the electricity supply.

South Africa.—Mossel Bay (Cape Province).—The T.C. is to proceed with the electric light scheme recommended by Mr. Charles G. Trevett, consulting engineer, of Cape Town, at an estimated cost of £30,000.

Oudtshoorn (Cape Province).—The T.C. is to borrow a sum of £14,000 for the purchase of a new battery and other plant.

St. Annes.—Loan.—Application is being made for sanction to borrow £3,000.

Surbiton.—Prices.—After an investigation of the accounts of the E.S. Co., the U.D.C. has withdrawn its opposition to the company's application for permission to increase the charges for electricity.

Richmond (Yorks.).—E.L. Scheme.—The T.C. is to ask the Gas Committee to consider the question of lighting the town by electricity, and to submit a report thereon.

Wakefield.—Loan Sanction.—The E.C. has received the sanction of the M. of H. to borrow £800 for the purchase of land for a new depôt and transformer station.

Whitehaven.—Loan.—The T.C. has applied for a loan of £1,000 for electricity meters, and to extend the mains to supply the new municipal dwellings, &c., at a cost of £1,680.

Willington.—E.L. Scheme.—The U.D.C. is to ask Messrs. Stakers & Love and the Newcastle E.S. Co. if they would be prepared to supply electricity, and on what terms.

Wimbledon.—Prices.—The T.C. has intimated that it is not to demand payment of a minimum charge of 13s. 4d. per quarter for electricity. The charge for lighting remains at 8d. per unit.

TRAMWAY AND RAILWAY NOTES.

Black Country.—Fare Increase.—Fares have been increased 50 per cent., with a minimum of 1½d. They have advanced 200 per cent. since the war.

Chesterfield.—Accident.—In a fog on the 10th inst., two tramcars collided, and several passengers were injured.

Cork.—Electric Vehicles.—On the subject of improving scavenging in the city, a report was submitted by the city engineer to the Health Committee embodying particulars in respect of the introduction of electric vehicles. It was estimated that if electrics were used, the cost of street refuse collection and domestic scavenging would be reduced by about £8,990 per annum, and it was pointed out that one electric could do the work of three horses and carts.

London.—L. & S.W.R.—According to the new official time-table just issued, the suburban electric train services will shortly be improved, and a number of trailer cars will be placed on many of the trains.

L.C.C. Fares.—The L.C.C. tramway fares, says the *Financial Times*, are to be revised again within the next fortnight.

Oldham.—Sale.—The arbitration proceedings in connection with the transfer and sale of the company's tramway system to local authorities covering the area will shortly take place. The Stalybridge, Hyde, Dukinfield and Mossley Joint Tramways and Electricity Board is taking over some portions of the undertaking. The joint board's tramways have been a burden on the rates ever since they have been in existence. The original capital expenditure of £185,000 on the electricity department has been increased to £362,000. Since the commencement of supply in 1904, a sum of £140,000 has been redeemed by means of a sinking fund, and £22,000 has been spent out of revenue. The present loan debt is about £200,000, but it is estimated that to-day the value of the electricity undertaking is £700,000. The generating station is to be extended by 3,000 kw. to 12,000 kw. The erection of a new generating station, to cost something like £250,000, is contemplated.

South Lincolnshire.—Light Railway Scheme.—A deputation recently interviewed the Board of Agriculture regarding the proposed light railway scheme, and strongly urged the desirability of adopting a broad-gauge system. A promise was given that the proposal should be fully considered. The scheme includes Holbeach Marsh railways, estimated to cost £99,000; Holbeach Fens, £121,000; Boston to Wrangle, £64,000; and Crowland, £34,000—a total of £319,000 estimated expenditure.

York.—New Routes.—The city engineer has been requested to report on the suggested routes required to complete the tramway system in the city. It is estimated that the total cost of the four extensions, including the provision of the necessary tramcars, will be £143,517.

There is a deficiency on the workpeople's traffic on the present cost of working of £2,780 per year, apart from capital charges.

TELEGRAPH AND TELEPHONE NOTES.

Barbados.—Land, says the *Times*, has been acquired for a cable station in Barbados by the Western Cable Co. in connection with the lines from Brazil to Barbados, and thence to New York.

Brazil.—It is reported that the Marconi Wireless Co. has proposed to the Government the construction of receiving and transmitting stations at Rio de Janeiro and Belem, Pará.

Continental.—Spain.—On a number of occasions, firms at Barcelona have requested assistance of the American Consulate General in decoding commercial cablegrams received from business houses in the United States. Frequently the messages are in codes that are not on file in the Consulate, or available in Barcelona.

Germany.—The new Germano-Swedish telephone cable has been laid to the Swedish coast, the end being landed on November 5th. This cable, in conjunction with the German coast cable, is 140 km. long.

Italy.—To remedy the notorious deficiences of the telephone service, the Government is going to systematise the services throughout the country, which will take three years to complete. There is also a scheme afoot to lay a complete network of underground cables radiating from Rome in all directions, while the building of new central exchanges in the capital is also to be undertaken.

Switzerland.—After five years, telephone communication was resumed between Switzerland and Bavaria on the 13th inst.

Wireless Telegraphy.—The P.M.G. announces that he is now prepared to consider applications for permission to use transmitting apparatus for experiments in wireless telegraphy. Applicants must be of British nationality. They must show that they have in view some definite object of scientific value or general public utility, and that they possess the necessary technical knowledge and operative skill. It is proposed to charge small fees to cover clerical expenses and the cost of inspecting the stations. Full particulars can be obtained from the Secretary, General Post Office, E.C. 1. Permits are already being issued under simpler conditions for stations limited to reception.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Aberdeen.—November 27th. Great North of Scotland Railway Co. Six or 12 months' supply of telegraph material. Stores Superintendent, 80, Guild Street, Aberdeen.

Australia.—Sydney.—City Council. January 5th, 1920. Electric Lighting Department. Outdoor H.T. switchgear (specification 766); air-brake switches (specification 565). Electric Lighting Department, Town Hall.—*Tenders.*

January 14th, 1921. N.S.W. Railways and Tramways Department. 70 3-phase induction motors for terminal wheat elevator.*

January 19th, 1920. Sub-station equipment (except power transformers). Contract No. 558.*

Melbourne.—P.M.G.'s Department. January 20th, 1920. Automatic telephone switchboard at Collingwood. Schedule 1,683. (September 19th.)

Bolton.—December 10th. Electricity Committee. E.H.T. switchgear for the Back-o'th'-Bank generating station. (See this issue.)

Dublin.—November 26th. Electricity Supply Committee. 20,000 arc-lamp carbons. (November 14th.)

Enniskillen.—December 1st. Sligo, Leitrim & Northern Counties Railway Co. 12 months' supply of electric telegraph material. The Secretary, Enniskillen.

London.—L.C.C. December 9th. Overhead electrical equipment, low-tension cable, and laying stoneware ducts, &c., in connection with the construction of the Lee and Eltham tramway. (November 14th.)

H.M. Office of Works. November 26th. 12 months' supply of incandescent electric lamps. (See this issue.)

Londonderry.—December 13th. Electricity Department. Two 500-kw. rotary converters with transformers, E.H.T. cubicles with switchgear, L.T. D.C. panels, cables, &c. (See this issue.)

Manchester.—December 1st. Rivers Department. Supply, &c., at Davyhulme sewage works, Urmston, of three 30-H.P., three-phase, induction motors, &c. Secretary of Rivers Department, Town Hall.

December 24th. Electricity Committee. Specification B1: two 25,000-kw. and two 1,000-kw., three-phase turbo-alternators, with condensing plant, comprising: main turbines, main alternators, main condensers, air and water extraction pumps and pipework,

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence), London.

house-service turbines, house-service alternators. Specification B2.: four 100,000-lb. water-tube boilers, 375 lb. working pressure, comprising: water-tube boilers, complete, steel economisers, air heaters, induced and forced-draught plant and chimneys, flues, coal chutes and ash hoppers, pipework and valves. Specification B3.: coal and coke handling and conveying plant, and wagon tippers, comprising: coal and coke conveyors, capacity 100 tons per hour, wagon tippers. (November 14th.)

Merton.—November 28th. Merton and Morden U.D.C. Two 2-ton electrically-driven dust vans and installation of a motor generator at the depôt. Mr. G. Jerram, engineer, Council Offices, Kingston Road, Merton, S.W. 19.

Newcastle-on-Tyne.—November 24th. Tyne Improvement Commissioners. Six and 12 months' supply of incandescent electric lamps and arc lamp carbons. Mr. J. McD. Mason, general manager and secretary, Berwick Street, Newcastle-on-Tyne.

New Malden (Surrey).—November 25th. The Maldens and Coombe U.D.C. Two 15-B.H.P. electric motors, and two 4-inch centrifugal pumps, at Kingston Vale pumping station. (November 14th.)

Plymouth.—December 5th. Corporation. Two water-tube boilers. (November 14th.)

Sowerby Bridge.—November 24th. U.D.C. Supply of a 20-B.H.P. electric motor at the sewage disposal works, Milner Royd. Mr. James Eastwood, Engineer and Surveyor, Council Offices.

South Africa.—JOHANNESBURG.—January 8th. Municipal Council. Copper wire, cable insulators and steel poles (Contract No. 548). Specification from Town Clerk, Municipal Offices, Johannesburg.—*B. of T. Journal.*

Tynemouth.—December 1st. Electricity Department. 5,500 yd., three-core, paper-insulated, lead-covered, 6,600-volt cable; 5,500 yd., four-pair, paper-insulated, lead-covered, telephone cable; 5,500 yd., three-core, conductor cable. (October 31st.)

Walthamstow.—November 26th. U.D.C. Electricity Department. Cast-iron circulating water pipes, E.H.T. and L.T. cable, engine room crane. (October 31st.)

CLOSED.

Belfast.—T.C.:—

Structural steelwork for new power station at the Harbour, £88,318.—Messrs. Ore, Watt & Co.

Glasgow.—Tramways Committee. Recommended:—

Special bolts and nuts for rails.—Ibbotson Bros. & Co., Ltd.
V.I.R. cables.—Liverpool Electric Cable Co., Ltd.
Weldless car-brake chains.—Weldless Chains, Ltd.
D.C.C. wire.—B.I. & Helsby Cables, Ltd.
Steel pinions for 49b. armatures.—Alfred Wiseman, Ltd.

London.—STEPNEY.—Electricity Supply Committee. Accepted:—

2,000 tons New Hucknall Deep 1¼ slack, at 25s. 11d. per ton.—A. Blackman and Co.
200 tons Northumberland rough small coal, 45s. 1d. per ton.—W. Cory and Son, Ltd.

10,000 pairs' yellow-flame arc-lamp carbons:—

Sloan Electrical Co., Ltd. ..	(accepted) ..	**£175**
General Electric Co., Ltd.	.. ..	196
W. White & Co.	.. ..	257

Northampton.—B. of G.:—

Telephones.—British Supply Telephone Association, £47, and £14 15s. per annum for upkeep.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, November 21st. At the Royal Society of Arts, John Street, Adelphi. At 7 p.m. Annual General Meeting. Paper on "The Limitations of Electric Tramways," by Mr. W. A. Tookey.

Electro-Harmonic Society.—Friday, November 21st. At 8 p.m. At the Holborn Restaurant (Venetian Chamber). Concert. Ladies' night.

Institution of Mechanical Engineers.—Friday, November 21st. At Storey's Gate, S.W. At 6 p.m. Paper on "The Present Position of Mechanical Road Traction," by Mr. C. G. Conradi.

Institution of Civil Engineers.—Tuesday, November 25th. At Gt. George Street, S.W. At 5.30 p.m. Paper on "Some Aspects of Metropolitan Road and Rail Transit," by Mr. H. H. Gordon.

Illuminating Engineering Society.—Tuesday, November 25th. At the Royal Society of Arts, John Street, Adelphi. At 5.30 p.m. Opening meeting. Address by the President on "The Work of Lambert."

Edinburgh Electric Club.—Wednesday, November 26th. At the Free Gardener's Hall. At 8 p.m. Lecture on "Electricity Supply from Water Power in Scotland," by Mr. J. M. M. Munro.

Royal Society of Arts.—Wednesday, November 26th. At John Street, Adelphi, W.C. 2. At 4.30 p.m. Paper on "British Trade in China," by Mr. H. B. Morse.

Institution of Electrical Engineers.—Thursday, November 27th. At the Institution of Civil Engineers, Gt. George Street, S.W. At 6 p.m. Paper on "Carbon Arcs for Searchlights," by Messrs. C. C. Paterson, J. W. T. Walsh, A. K. Taylor and W. Barnett.

(**North-Eastern Centre**).—Monday, November 24th. At the Armstrong College, Newcastle-on-Tyne. At 7.15 p.m. Lecture on "Wireless Telegraphy in the Mercantile Marine," by Mr. W. D. Owen.

(**North-Midland Centre**).—Tuesday, November 25th. At the Victoria Hotel, Sheffield. At 7 p.m.: Visit of the President, Mr. R. T. Smith. Discussion on "The Use of Electrical Machinery in Goods stations and Yards," to be opened by the President.

Electrical Power Engineers' Association (Derby and District Section).—Thursday, November 27th. At the County Hotel, Marysgate, Derby. At 7.30 p.m. General meeting.

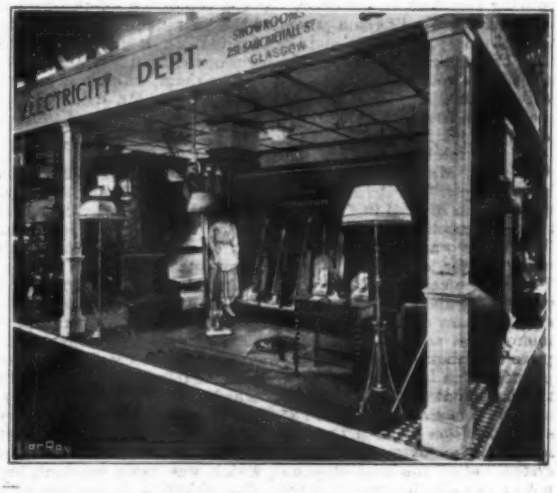
NOTES.

Edinburgh Electric Club.—An Electric Club is to be formed at Edinburgh. This decision was reached at a meeting held on November 12th, when a small Committee was appointed to make arrangements for a syllabus, &c. It is intended to hold lectures, visit works, read and discuss papers, and so on. The first meeting will take place on Wednesday, November 26th, in the Free Gardener's Hall, at 8 o'clock, when Mr. J. M. M. Munro, A.M.I.C.E., M.I.E.E., will deliver a lecture on "Electricity Supply from Water Power in Scotland." The club will have an annual subscription of 5s. for men and 2s. 6d. for apprentices. The temporary Committee consists of Messrs. T. S. Munnoch, D. Ferguson, and D. S. Munro.

Housing and Transport.—A large number of firms which are devoting special attention to housing schemes are represented at the Public Works Exhibition in the Royal Agricultural Hall, which opened yesterday. On the closing day (November 27th), Dr. Addison, the Minister of Health, will address a Housing Conference of Members and Officials of Local Authorities, which has been arranged by the Institution of Municipal and County Engineers.

This Exhibition is being held simultaneously with the Roads and Transport Congress and Exhibition, initiated by the County Councils Association, which will be opened by Sir Eric Geddes, Minister of Transport. The whole of the available space has been filled with a collection of exhibits of exceptional interest to local authorities, engineers, and architects. Both Exhibitions have been organised by Mr. A. F. May (managing director of the Municipal Agency, Ltd.), who will be remembered as the chief organiser of the great Metropolitan War Loan campaign of 1917.

A Glasgow Exhibition.—Glasgow Corporation's electricity department was well represented at the Housing and Health Exhibition, which has just completed a successful session, and is estimated to have been visited by about half a million callers. The department's stand occupied 45 ft. by 20 ft. Among the principal items shown was a cooking range under working conditions, with a practical baker who demonstrated the potentialities of the outfit. There were also shown cookers by Carron Co., the Falkirk Iron Co., Jackson's, Belling's, and Premier Electric Heaters, &c. A skilled operator from a city laundry demonstrated with the electric iron, and the Thor washing and ironing machines were also shown. Standard makes of vacuum cleaners were exhibited in operation,



GLASGOW CORPORATION STAND.

including the Imperial, Premier, and Hoover. There was a large display of electric fires, which included representative designs from the Falkirk Iron Co., Carron Co., Belling, Quead, and Credenda Companies. There were also shown the Hedlite heater and pedestal fires by the Credenda and Ediswan Companies. Water-heating appliances were stalled by the Falkirk Iron Co., with calorifier sets and geyser types by the British Electric Trading Co. The Filbar electric water boiler for domestic tea making, &c., was shown for the first time in this country. This apparatus gives boiling water up to two pints in half to one minute. The usual variety and artistic selection of kettles coffee percolators, &c., as well as two show cases showing standard lamps, &c., were included.

The Channel Tunnel.—The Prime Minister, on the 12th inst., received a Parliamentary deputation, led by Sir Arthur Fell, M.P., which pointed out the urgent need of constructing the tunnel. The Premier, who gave general approval to the project, said that all political objections had been removed. The Cabinet had recently discussed the matter, and all Ministers who had before the war opposed it, were now in favour of the tunnel. The Cabinet had asked the War Office to present a Memorandum on the subject, on the receipt of which it would discuss the matter again.

Institution and Lecture Notes.—Society of Arts.—The arrangements for the present Session, which opened on Wednesday with an address by Sir H. Trueman Wood, chairman, on "Science and Industry," include the following;—

November 26th.—At 4.30 o'clock. H. B. Morse, LL.D., "British Trade in China."
December 10th.—At 4.30 o'clock. Sir Oliver Lodge, "Possible Sources of Energy."
December 17th.—At 4.30 o'clock. Dr. W. Cramp, M.I.E.E., "Pneumatic Transport."
Mondays, March 15th, 22nd, 29th.—At 8 o'clock. Dr. W. Rosenhain, F.R.S., "Aluminium and Its Alloys."
Wednesdays, January 7th and 14th.—At 3 o'clock. Juvenile Lectures. L. Pendred, Editor *Engineer*, "Railways and Engines."

The following papers are to be read after Christmas:—

A. E. Hayes, "The English Language and International Trade."
S. Preston, C.I.E., "English Canals and Inland Waterways."
Brigadier-General Sir H. P. Maybury, K.C.M.G., M.Inst.C.E., "Road Transport."
J. Currie, C.M.G., Ministry of Labour (Training Department), "Industrial Training."
Sir Cecil Hertslet, late H.B.M. Consul-General for Belgium, "The Ruin and Restoration of Belgium."
Lord Montagu of Beaulieu, C.S.I., "Motor Transport in India."
Sir G. C. Buchanan, K.C.I.E., M.Inst.C.E., "The Ports of India: Their Administration and Development."

Technical Inspection Association.—An interesting paper was read at the Society of Arts on Friday evening, the 7th inst., before the above Association, by Prof. Baly, C.B.E., F.R.S. (of the University of Liverpool), on the subject of "The Spectroscope in the Science of To-day," the chair being occupied by the President of the Association, Mr. A. H. Collinson, C.B.E., M.Inst.C.E.

Prof. Baly dwelt upon the extreme importance of the spectroscope in all research work, giving instances of its extended use by astronomers, chemists, and physicists, but the line of demarcation between them was so defined that very little information as to the work done by any one was known to either of the others. Prof. Baly urged the importance of the extended use of the spectroscope in all branches of scientific investigation, and said he believed the time was approaching when it would be in daily use by the commercial exponents of applied science as much as by those working in the realms of pure science.

The lecture was illustrated by lantern slides, and was received by the members of the Association—all practical men on the applied side of technology—with much appreciation, some of them having already made use of the spectroscope for investigations in workshop practice.

Institution of Electrical Engineers.—The very successful and largely attended opening meeting of the 1920 session of the Institution took place on Thursday evening, last week, at the Institution of Civil Engineers, Mr. C. H. Wordingham, C.B.E., retiring president, in the chair. At the conclusion of the formal business Mr. Wordingham presented the premiums awarded by the Council for papers read, and then invited Mr. Roger T. Smith to take the chair. Mr. W. M. Mordey proposed, and Mr. Woodhouse seconded, a vote of thanks to Mr. Wordingham, which was carried with acclamation. Mr. C. P. Sparks proposed, and Mr. J. S. Highfield seconded, a vote of thanks to Mr. Smith for his inaugural address, which is reported elsewhere in this issue.

At a meeting of the North-Eastern Centre on the 10th inst., Mr. W. Cross in the chair, Dr. W. M. Thornton lectured upon "Electrical Under-Water Signalling." He said that the problem divided itself into two parts, that of transmission, and that of reception, of which the more difficult was reception. Before the war there was no means of receiving exact signals under water, except by listening-trumpets and similar devices. The development of microphones was largely to the credit of one of their members. The common form of hydrophone was a substantial mass of metal, slightly recessed for the reception of the microphone, and in front was a plate of phosphor-bronze. The plate was shaken by the sound waves, which actuated the microphone, which in turn was connected to the telephone receiver. In the development of this idea, some standardisation was necessary, and one firm alone dealt with 35,000 of them, which showed very small variation between themselves. These stood quite a lot of rough usage, over a considerable time. There was another system called the magnetophone, which was more constant, but not so suitable for rough usage. One objection to the use of a portable hydrophone, was that the vessel had to be stopped to listen. The Germans knew all about these hydrophones, and fitted them upon their submarines—a number along the length of the craft on either side. These could be used when the boat was driven by motors, submerged. The lecturer also dealt with other modes of receiving the signals under water, mentioning the Walser gear, towed bodies, the "Rat," the "Porpoise," the Nash fish, and the Lancashire fish, the latter having three microphones. The simplest form of transmission was that of the pneumatic hammer which struck on a piece of pig-iron in the ship's bottom, and in this way a message could be transmitted by means of the Morse code. This transmitter had a range of a few miles, but was really limited by the means for reception. The first electrical transmitter was on the Fessenden method. This was being used before the war in America, and was now in daily use for under-water signalling. It was very noisy, but very penetrating, and had a range of from 10 to 15 miles, and anything from 20 to 40 miles with amplified reception. But in war-time there was the objection that the method gave the whole position away. They wanted secrecy, and that had been obtained; sounds had been sent out that could not be detected by the human ear. The frequencies necessary were easily obtainable by means of electricity, but it was not so easy to get any material to follow them. In this connection they had been able to utilise certain electrical properties of matter. The further pursuit of this method was stopped by the Armistice, but he trusted that it would not be lost sight of. There was one disadvantage of the use of this system, which was that the use of a beam of sound made the search for an object in the sea like looking for a needle in a hay-stack. This could be avoided by sending out a wide diverging sound, and receiving directionally. Dr. Thornton gave a display of an electric device suitable for this purpose, and, in concluding, alluded to the "leader" gear by which a vessel in darkness, or in fog, might be guided into port by electric direction. Mr. C. P. Sparks, ex-President of the Institution, who was present, made a few remarks, especially with reference to the visit to Holland by some of the members.

Junior Institution of Engineers.—The Council of the Junior Institution of Engineers has received a petition from Assam, signed by a number of engineers engaged for the most part in the tea industry, but also in railway and other public services, to sanction the formation of a Local Section of the Institution in that district. At an inaugural meeting held at Tinsukia, on September 8th, Mr. E. F. Heron, M.Inst.C.E., executive engineer, Lakhimpur Division, was elected chairman; Mr. E. L. Greenhough, agent and general manager, Assam Railway and Trading Co., vice-chairman; Mr. J. F. Brebner, engineer and acting manager, B.I. Tea Co., Ltd., hon. secretary; and applications for membership were signed by many engineers holding responsible positions throughout Assam. The standard of membership has internationally been made, so as to ensure the acceptance only of qualified men of undoubted ability.

This is the second Colonial Section of the Institution to be established within a year. The Local Sections now established in Australia and Assam, added to the five other Local Sections in England, would appear to warrant a revision of the name of the Institution.

West of Scotland Iron and Steel Institute.—At a meeting held at Glasgow, on November 14th, Mr. J. Bibby gave a lecture on "Electric Furnaces." Mr. Bibby stated that over 400,000 tons of pig-iron were now produced annually in electric shaft furnaces, and plant was at present in course of construction which it was estimated would nearly double the present production.

Royal Institution.—The Juvenile Lectures will be delivered this Christmas by Prof. W. H. Bragg, on "The World of Sound." The lectures will be given on the following days, at 3 o'clock;—

Tuesday, December 30th.—"What is Sound?"
Thursday, January 1st.—"Sound and Music."
Saturday, January 3rd.—"Sounds of the Town."
Tuesday, January 6th.—"Sounds of the Country."
Thursday, January 8th.—"Sounds of the Sea."
Saturday, January 10th.—"Sound in War."

Royal Society.—The President and Council will recommend for election as President at the anniversary meeting, on December 1st, Sir Joseph J. Thomson, O.M., Cavendish Professor of Experimental Physics at Cambridge.

Wireless Society of London.—The next general meeting has been arranged to take place at the Institution of Civil Engineers, Great George Street, Westminster, on Wednesday, November 26th, at 6 p.m. After the business of the meeting, Mr. J. Scott-Taggart, M.C., A.M.I.E.E., will read a paper on "A System for the Reception of Continuous Waves," after which the meeting will be open for discussion. Mr. Scott-Taggart is head of the valve department of Messrs. Ediswan, Ltd.

The Hon. Secretary of the Wireless Society, Mr. Leslie McMichael, notifies us of his change of address to 32, Quex Road, West Hampstead, N.W. 6, and all communications with regard to the Society should be so addressed after November 23rd.

Appointments Vacant.—Assistant electrical engineer (£360 + £75 + 30 per cent. on salary as war bonus), for the Government of the Federated Malay States Electric Lighting Department; business representative, for the Stoke Newington B.C. Electricity Department; shift engineer (79s. 6d.), for the Peterborough Corporation Electricity Works; laboratory attendant in the electrical department (18s. + 20 per cent. + war bonus), for the L.C.C. Hackney Institute; chief of the electrical engineering department (£250 to £300 + £110), for the Crawford Municipal Technical Institute, Cork; chief instructor in physics and electrical engineering (£400), for the Seddon Memorial Technical College, Auckland, New Zealand; meter department charge engineer (£5), for the Southend-on-Sea Corporation Electrical Supply Department; cable jointer, for the Barrow B.C. Electricity Department. See our advertisement pages to-day.

Subaqueous Sound Ranging.—Sound ranging at sea by means of hydrophones, which proved of great value for war operations, will, if developed, be of great benefit to shipping under peace conditions. Sound-ranging stations are at present established at St. Margaret's Bay (Dover), Easton Board (Lowestoft), Flamborough Head, Peterhead, and Limerick. The last three, however, are being closed. The method, in its present state, is unsuitable for commercial use; it is, however, capable of great development. Shipping companies and others interested, with a view to adopting this method for assisting in ship navigation, are invited, says *The Times*, to communicate with the Admiralty by letter, when further details may be obtained and actual trials possibly arranged.

London Traffic.—The Advisory Committee on London Traffic has appointed a Technical Sub-Committee of 18 members, divided into three sections, for special investigations, namely: Sub-Committee on Traffic Regulation, chairman, Lt.-Col. C. H. Bressey; Sub-Committee on Improvement of Street Facilities, chairman, Mr. J. S. Killick; Sub-Committee on London Traffic, chairman, Sir A. Gibb.

The New Cable Standards.—The accompanying table has been issued by the Cable Makers' Association to facilitate the change from the old to the new standards :—

New standard.		Old standard.	
New nominal area in sq. in.	No. and diameter in inches of wires composing conductor.	No. and gauge or diameter in inches of wires in conductor.	Old nominal area in sq. in.
·0010	1/·036	1/20 S.W.G.	·0010
·0015	1/·044	—	—
—	—	1/18 ,,	·0018
—	—	3/22 ,,	·0018
·0020	3/·029	—	—
—	—	7/25 ,,	·0022
·0030	3/·036	3/20 ,,	·0030
—	—	7/23 ,,	·0031
·0030	1/·064	1/16 ,,	·0032
—	—	7/22 ,,	·0042
·0045	7/·029	—	—
—	—	7/21½ ,,	·0049
·0070	7/·036	7/20 ,,	·0070
—	—	7/19 ,,	·0086
·0100	7/·044	—	—
—	—	7/18 ,,	·0125
·0145	7/·052	—	—
—	—	7/17 ,,	·0170
·0225	7/·064	7/16 ,,	·0221
—	—	19/18 ,,	·0338
—	—	7/14 ,,	·0346
·0400	19/·052	—	—
—	—	19/17 ,,	·0459
·0600	19/·064	19/16 ,,	·0600
·0750	19/·072	19/15 ,,	·0750
—	—	19/14 ,,	·0937
·1000	19/·083	—	—
·1200	37/·064	37/16 ,,	·1168
—	—	19/13 ,,	·1250
·1500	37/·072	37/15 ,,	·1500
—	—	37/14 ,,	·1824
·2000	37/·083	37/·083 in.	·2000
·2500	37/·093	37/·092 ,,	·2500
·3000	37/·103	37/·104 ,,	·3000
·4000	61/·093	61/·092 ,,	·4000
·5000	61/·103	61/·104 ,,	·5000
·6000	91/·093	61/·112 ,,	·6000
·7500	91/·103	91/·101 ,,	·7500
1·0000	127/·103	127/·101 ,,	1·0000

Inquiry.—Makers of the "D. L. S." reflector are asked for.

The Midland Ball.—The Midland Electrical Engineers' Ball, which was held at the Grand Hotel, Birmingham, on the 13th inst., proved to be a greater success than any which have taken place on previous occasions. No fewer than 325 guests assembled, many of them coming from distant parts of the country. Mr. G. J. Bish, the hon. sec., is to be congratulated upon the excellence of the arrangements. The expressions of appreciation which were heard on all sides augur well for the success of future dances. During the supper interval a presentation was made, on behalf of the Committee, to the eldest daughter of the chairman, Mr. R. A. Chattock, whose birthday happily coincided with the date of the ball. Mr. Archibald Joyce's orchestra proved a very great attraction, and induced many of the older members of the electrical fraternity to compete with their younger brethren in treading the modern measures that are now so much the vogue. Many applications in excess of the accommodation were received, and the Committee wishes to express its regret at the disappointment which was incurred on this account. It hopes that next year applications will be made in ample time to ensure tickets being obtainable.

Fatalities.—An inquest was held on Monday at South Bank, near Middlesbro', into the cause of death of Oswald Guest, aged 25, who was in charge of an electric charger at the Cleveland Steelworks of Messrs. Bolckow, Vaughan & Co. It was stated that deceased, instead of stepping on to the ground to get to a switch, attempted to walk along a girder, slipped and fell on to wires charged at a voltage of 440. His hand, with which it is supposed he gripped the wires as he fell, was burned to the bone, and death was instantaneous. Mr. Hodges, electrical engineer to the firm, said it had been found quite impracticable to cover the wires. There was only a small clearance, and it was only possible to place above the wires a thin sheet of metal. This had been done, but there was a danger of the metal protection becoming dented and coming into contact with the live wires. Consequently, these protections had been removed. The matter of the danger of these open wires had been put before the makers with certain suggestions by the firm. The Coroner, in returning a verdict of "Accidental death," said he appreciated the firm's difficulties, but at the same time he was glad it still had the matter in hand.

An inquiry was held at Arbroath, by Sheriff Gordon and a jury, into the circumstances of a fatal accident which befell Robert Marshall, in the employment of Messrs. James Keith & Blackman, Ltd. Marshall, it was stated, was standing on a ladder placed against an overhead electric travelling crane, replacing a rope on a pulley of the crane, when the crane was put in motion and moved away from the ladder. The result was that Marshall fell with the ladder to the floor, a distance of about 22 ft., and was so seriously injured about the head that he died the same day. The jury added a rider to the formal verdict, to the effect that in their opinion, it was a case of misjudgment on Marshall's part, and that no fault could be attributed to the employers or anyone, and that ample precautions had been taken for safety.

Hydro-Electric Power in Tasmania.—The policy of the Government seems to be directed to building up the electrolytic zinc industry at Risdon, near Hobart. Power is being made available cheaper there than the price the Government is understood to have asked for power from the King River. It has been publicly stated, and not denied, that the price asked respecting the King River supply is £4 10s. per horse-power per annum, with conditions of lengthy contract and a sinking fund for the supply of 22,000 horse-power annually. On the other hand, the Tasmanian Government has just entered into a new contract with the Electrolytic Zinc. Co. of Australia Pty., Ltd., for the supply of power as follows :—(1) 4,000 H.P., which is already being supplied; (2) 11,000 H.P., to be supplied in two years; (3) 15,000 H.P., to be supplied in three years; (4) 5,000 H.P., at a date to be arranged. The most important modification of the old contract is as to price. The original contract fixed the price at £3 10s. per H.P. per annum for the first block, and £2 per H.P. per annum for the first and second blocks together. The company has therefore agreed to share with the department such profits as it may make over and above 8 per cent. on the capital expenditure of its undertaking after due allowance has been made for working expenses, amortisation, &c., by increasing the price for the four blocks by 2s. per H.P. per annum for each increase of 1 per cent. on the net profits above 8 per cent., and *pro rata* for any portion of 1 per cent., with a maximum increase of 10s. per H.P. per annum. This position gives such a decided preference over the conditions and terms said to be demanded from the Mount Lyell company in respect of power from the King River that the latter company naturally hesitates. It may be said that the company is now awaiting a reasonable proposition from the Tasmanian Government, instead of the latter waiting on the company.

It is rumoured that the laboratory experiments in connection with the electrolytic process are proceeding satisfactorily at Queenstown, and it may be expected that the preliminary investigations will soon be finalised.

The Energy Component in Industry.—The degree to which energy in any of its varied forms now enters into the production of a raw material or into the manufacture of a finished product measures the extent to which man, through the use of his intelligence, has succeeded in obtaining the assistance of natural forces. The purpose of an article in the *Electrical World* of September 20th, is to show the relation between the quantity and value of energy used and the other elements that go to form industrial products, and to show the extent to which the energy used is in the form of electric power. The statistical information relied upon relates to production in 1914, and about 275,000 plants were actually covered by the investigation, all important industrial establishments being included.

The various branches of manufacturing employed in 1914 8,263,000 persons, utilised over 22,000,000 H.P., and turned out products valued at over $24,000,000,000. In comparison with the year 1909 there was an increase in number of wage earners of 6.4 per cent., while the value of products increased 17.3 per cent. "Primary power" (all power that was primary from the standpoint of the manufacturing establishment using it) increased about 20.7 per cent. during the five-year period, although the advance in the cost of energy was only 17 per cent. The primary H.P. installed increased during the same period from 2.8 to 3.2 for each wage earner employed. The cost of fuel and power, on the other hand, decreased from $30.60 to $29.50 for each H.P. of primary power installed. The average annual wage for the industries represented increased from $517 to $570. Thus a 20 per cent. increase in power equipment was accompanied by a 10 per cent. increase in the average wage, and by a 3 per cent. decrease in the average cost of energy per H.P. These figures cover a period of normal industrial development in the United States. In the year 1914 industry was not yet greatly stimulated by the European war, and comparisons with 1909 may, therefore, be accepted as free from highly abnormal influences, and are significant of the normal tendencies of the use of power in industry. In 1909 for 18,675,346 H.P. of primary power there was installed 4,817,140 H.P. of electric motors, while in 1914 these figures had increased to 22,547,574 H.P. and 8,847,622 H.P. respectively. Expressing the conditions in another way, in 1909 25.8 per cent. of manufacturing power was electrified, while in 1914 the ratio was 39.3 per cent., an increase of 84 per cent. in motor installation, and of 52 per cent. in degree of electrification. Further, in 1909 36.3 per cent. of the motors were driven by purchased energy, while in 1914 the proportion had increased to 44.2 per cent. This growth of the use of electricity may well explain the decrease in energy cost, although the statistics are not sufficiently detailed to establish a direct relationship.

The Registration of Civil Engineers.—The Council of the Institution of Civil Engineers has announced that the members generally have, by a very great majority, intimated their approval of the proposal which was placed before the Institution in July, that steps should be taken to obtain statutory powers to regulate and establish registration for the civil engineering profession. Accordingly the Council has resolved to introduce a Bill in the next Session of Parliament with a view to effect this object.

The preparation of the Bill has engaged the most careful consideration of the Council, not only as regards its effect in the public interest and that of the members of the Institution, but also in relation to the interests of the various important engineering societies, and of persons now engaged in civil engineering practice who may not be connected with any such societies. In the consideration of these matters, due attention has been paid to the opinions and observations which have been communicated to the Institution by the members.

The principal provisions of the Bill cover the following points:—

By "Civil Engineer" is meant a person competent in the art described in the Royal Charter of the Institution of 1828, and its subsequent development through the advance of science. The register as first established would contain (*a*) all corporate members of the Institution of Civil Engineers and of the Institution of Civil Engineers of Ireland; and (*b*) other persons who are engaged as civil engineers and are members of important engineering societies, or who, although not members of such societies, have been engaged in civil engineering practice for a substantial period. There would be a time limit for the application of these conditions to the formation of the register. For the purpose of determining the eligibility of individuals comprised in the group (*b*), a tribunal would be established upon which the important engineering societies would be duly represented and by means of which the interests of their members who are civil engineers would be safeguarded.

After registration has been established on these lines, it is intended that the general conditions which have been or may be laid down by the Institution of Civil Engineers as applying to its corporate membership should be required as a qualification for admission to the register of civil engineers.

It is sought to reserve the use of the title "Civil Engineer" for persons so registered, and to prohibit unregistered persons from assuming that title. It is not intended to limit the register to corporate members of the Institution, and the restrictions placed on the exercise of civil engineering functions are very limited; whilst the rights of any person to use the authorised title of any society of which he may be a member are, of course, not interfered with.

Mine Explosions.—During a snow storm with thunder last week at Dalton-in-Furness, lightning followed the winding rope down the shaft of a mine and ran along the bottom of the pit for 200 yards. A man at the top of the pit was knocked down unconscious, and a boy temporarily lost the use of his legs. The last report of the Chief Inspector of Mines in India contains an account of a remarkable explosion of fire-damp caused by a discharge of lightning in the new shaft at the Sitalpur coal mine, belonging to the Bengal Coal Co. The explosion occurred during a thunderstorm, and the evidence showed that a flash of lightning had, to all appearances, passed down the shaft causing disruptive discharges at certain points between the guides and the winding rope, rending the latter at two places situated respectively 228 ft. and 278 ft. from the surface. The distance between the winding rope and the side of the shaft was 5 ft. 4 in., indicating a spark gap of this width, and an intensity of discharge which could not fail to ignite the explosive mixture of gas and air known to be present in the shaft. There is apparently no limit to the vagaries of lightning, and the occurrence, rare as it is, is of interest as indicating possibilities. According to the *Colliery Guardian*, in 1915 Mr. Ferey described in a paper read before the Société de l'Industrie Minérale phenomena similar in character to the above.

In a paper, read by Mr. W. A. Douglas Rudge before the Royal Society of London, it was shown that the mere raising of a dust cloud produces a large amount of electricity, the sign of which depends upon the material used. Generally, acid particles become positively and basic particles negatively electrified. Previously, in 1901, Hesehus had shown in Russia that pieces of the same material when rubbed together become electrically charged with the same sign, while the dust abraded in the process receives a charge of an opposite sign. These charges are sufficiently persistent to be measurable with a suitable electroscope. Thus a puff of air containing 5×10^{-9} gr. of dust of mercuric sulphide gave a charge to a collector of several volts; while a centigram of cornflour, blown into a large room, charged the air to an extent which raised the charge on a collector to a potential of 200 volts, and the effect persisted for some time. In the course of the investigation in connection with the Minnie pit inquiry recently concluded, evidence was given as to the behaviour of the roof of the Bullhurst seam, which by rubbing under earth strain in the roof and also by falling upon similar pieces on the floor, developed flares and flashes which seem to differ from ordinary friction sparks, and were referred to by Dr. Wheeler in his evidence as frictional electricity sparks. There is no reason to doubt the evidence of eye-witnesses regarding the character of the sparks seen at the Minnie pit. The length of flame alone seems to preclude the idea of mere frictional sparks, and if in fact they were electrical, a temperature exceeding the ignition temperature of methane might easily be reached.

In this connection the *Colliery Guardian* recalls the circumstances of the explosion at the Maindy pit, Glamorganshire, in 1896, where a similar explanation seems to be sufficient to account for the occurrence, as also in the case of the Bellevue explosion, Alberta, occurring at intervals between 1910 and 1911, some of which took place when nobody was in the pit. These were investigated by Mr. J. T. Stirling and Sir John Cadman, and are believed to have been due to sparks produced by falling stones. Experiments showed that the hard siliceous roof gave a brilliant display of sparks on falling, and when struck with a hammer the surface of percussion glowed red hot for an instant, owing probably to the ignition of bituminous matter in the stone. The sparks obtained by friction of one stone upon another could be made to ignite coal gas, a result which has not yet been obtained at the Minnie pit.

"Safety First" Methods.—Every year thousands of lives are lost, tens of thousands of casualties occur, and millions of pounds are wasted, through industrial accidents. Yet, though this hideous wastage of blood and treasure continues in ever swelling volume, employers and workers alike do little to amend the situation. Either they regard accidents as inevitable, like the tides and seasons, or they are sceptical as to the value of remedies that lie within their grasp.

Experience shows that accidents are not inevitable, and that they can be prevented by the use of "Safety First" methods and practices. In 1916 deaths and injuries were reduced 47 and 46 per cent. respectively on all railways in the United States, as a result of the use of "Safety First" methods.

An important metropolitan company, during the past five years, reduced accidents by 70.9 per cent., and compensation claims by 57 per cent. A large firm in the North of England in a single year reduced the number of accidents in its works more than 50 per cent.

But apart from the question of human life, which must ever remain the paramount consideration, the employer has every incentive that self interest can supply, to adopt the "Safety First" creed. Accident prevention pays. The United States Steel Corporation, in the nine years ended 1915, saved 14,067 employés from death and injury, and after deducting expenditure on "Safety First" propaganda, was millions of dollars to the good.

Premiums paid by British firms which have tried "Safety First" methods, have been reduced in respect of employers' liability and workmen's compensation by nearly 50 per cent.

Dr. Zacker, the Director of the Imperial Bureau of Statistics in Berlin, has stated that the amount of money saved annually in Germany by attention to "Safety First," and to health of employés, extends to one thousand million marks, that is, to 50 million pounds. A similar saving can be effected in England.

The British Industrial "Safety First" Association is working a silent revolution in the commercial life of this country. Backed by six Government departments, and supported by leading employers and trade unions, it strikes a human note, to which representatives of Capital and Labour are proving responsive and sympathetic. It forms a point of contact between employer and worker. They meet on "Safety First" Committees, and learn to know and understand each other. A prominent manufacturer said that he would consider every penny expended on safety work had been well spent, even if a single life had not been saved, or an accident prevented, because of the good feeling which had been engendered as a result of "Safety First" conferences between his employés and himself.

The work of the Brit. Ind. "Safety First" Association needs no better commendation. Its address is 47, Fleet Street, E.C.

OUR PERSONAL COLUMN.

The Editors invite electrital engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—Southampton T.C. has appointed Mr. Howat, power station superintendent, as chief assistant to the electrical engineer at a salary of £425 a year, and Mr. Hooper as power station superintendent at £300 a year.

Mr. L. Gillitt, station superintendent at the Whitehaven Corporation Electricity Works, has resigned.

A gathering to welcome home a further 75 men who had returned from the Forces was held by the Birmingham Electric Supply Department on Saturday last. Mr. E. J. Jennings, secretary to the department, presided at a dinner and concert, in the absence of Mr. R. A. Chattock, through indisposition. Major Taylor and Lance-Corporal Devaney responded on behalf of the men.

General.—Amid the customary ceremony and in the presence of a crowded Council Chamber, Ald. Alex. Sinclair, chairman, Swansea Corporation Electricity Committee, was duly installed Mayor on November 10th. A number of speeches were delivered, referring to the great services rendered by him to the electricity undertaking and in many public capacities during his 33 years in Swansea and 22 years as a member of the Council. The new Mayor, in returning thanks, said in regard to the aftermath of the war that he already saw a silver lining to the clouds.

The annual staff dinner of the Swansea Corporation Electricity Department took place at the Hotel Camson on Thursday last week, when the Mayor (Ald. Alex. Sinclair) was the guest of the evening, and came in for a rousing reception upon his presence at the first social function since taking office as Chief Magistrate. He was supported by Mr. J. W. Burr (borough electrical engineer) and several members of the Corporation. The Borough Electrical Engineer presided, and after dinner proposed the toast of "The Committee," coupling with it the name of the Mayor. On behalf of the department, he congratulated the Mayor upon his election, and said that the Mayor, as chairman of committee, had seen the department grow from infantile into lusty proportions. The policy adopted in Swansea had always been a progressive one. The toast was honoured amid much enthusiasm. The Mayor, in responding, spoke of the splendid work of the department for several years past, and said its success was primarily due to the loyalty and co-operation of the staff and men. Other toasts included "Members returned from service."

At the meeting of the Marylebone Borough Council, on November 10th, Mr. Duncan Watson (of the firm of Duncan Watson & Co.), in returning thanks for his election as Mayor of the borough, referred to the matters of first importance that would fall to them, and indeed to all of us, to consider during the coming year, such as public health, education, and industrial unrest; the last of these were merely the outward expression of ambition in unaccustomed form.

Mr. G. C. Reed has recently left the employment of the Sunderland Forge and Engineering Co., Ltd., after 20 years' service, the latter half as manager of the installation department, where he had charge of all installation work in the United Kingdom and abroad. On October 25th Mr. Reed was presented with a cut-glass and silver flower vase by the inside staff and officials. On the evening of the same day the workmen and assistants of his department gave a dinner in his honour, and presented him with a gold watch and chain. Mr. Reed has started in business on his own account as George C. Reed & Co. at 27, Frederick Street, Sunderland, where he will specialise more particularly in electrical installation for ships, also the fitting out of shipyards, factories generally, sub-stations, and the carrying out of high-class house installations. He desires to receive price lists and catalogues of D.C. generating sets from 1-30 KW. output, steam, oil or petrol driven, and of all classes of installation material.

Mr. S. F. Palmer, who was for a number of years experimental engineer to Ferranti, Ltd., has severed his connection with his company, and has been appointed Australian representative for Messrs. Ferguson Pailin, Ltd. Mr. Palmer sailed on the ss. *Ormonde* for Sydney, where he will open up a central office.

Mr. H. K. Beale has been appointed chairman of the Birmingham Electric Supply Committee in place of Mr. J. B. Burman, who was not elected at the recent municipal election. Mr. Beale has been a member of that committee for several years. He is a solicitor and a member of the firm of Messrs. Beale & Co.

Councillor W. Perks, J.P., director of the Oswestry Electrical Co., Ltd., has been elected Mayor of the borough.

Glasgow T.C. has elected ex-Bailies Kennedy and Sadler convener and sub-convener respectively of the Electricity Committee, with ex-Bailie Kelly and Bailie M'Whirr convener and sub-convener of the Tramways Committee.

Captain J. Young, Tyne Electrical Engineers, has been seconded for service with the R.A.F. Lieut. R. G. Picking, Kent Fortress Engineers (Electric Lights Company) has relinquished his commission owing to his health, suffering from wounds received in action in France. Lieut. F. J. Adendorff, M.C., Tyne Electrical Engineers, has been restored o the establishment of his regiment, of which he was a supernumerary officer whilst employed regimentally.

Mr. H. Nicholson, B.Sc., who is at present working under the Ministry of Munitions, has been appointed to the vacant lectureship in Faraday House Electrical Engineering College.

Mr. Percy E. Rycroft has resigned his position as technical adviser to the Controller of Coal Mines, in order to take up an important appointment with Messrs. Babcock & Wilcox.

After five years on military service, Mr. J. Wayne-Morgan, M.I.E.E., has re-started his practice as a consulting engineer at 5, Pembroke Terrace, Cardiff.

Dr. R. H. Pickard, D.Sc., Ph.D., F.R.S., has been appointed Principal of the Battersea Polytechnic. Dr. Pickard has been principal of the Municipal Technical School, Blackburn, since 1908, and has been for some years consulting chemist to the Corporation of Blackburn and the Blackburn Cotton Employers' Association. He has done much for the advancement of chemical knowledge by the publication of the results of his researches in the transactions of various learned societies. During the war his services as a research chemist were given voluntarily to the Explosives Supply and Chemical Warfare Committee of the Ministry of Munitions.

Captain F. H. Masters, O.B.E., A.M.I.E.E., London Electrical Engineers, has vacated the appointment of adjutant as from the 1st ult.

The King has been pleased to confer upon Major W. M. Buck, Tyne Electrical Engineers, the Territorial decoration.

Warrant Electrician A. W. Jane has been appointed to H.M.S. *Diligence* on commissioning.

Mr. S. H. Richards, late of the Calcutta Electric Supply Co., has joined the sales staff of Messrs. Ferranti, Ltd., Hollinwood, as sales engineer for the South of England.

Obituary.—Mr. S. Fortescue.—The death has occurred at the age of 39 years of Mr. S. Fortescue, for some years a member of the staff of the electricity department of the Southend-on-Sea Corporation.

It is reported in the Press that Dr. John Aitken has passed away at Falkirk. He was an intimate friend of the late Lord Kelvin, and was himself a distinguished scientist. Among other things, he was the inventor of instruments for counting dust particles in the air, &c., and he received honours from a number of scientific societies.

Captain H. Gregory.—The death has occurred at Thatto Heath, St. Helens, from pneumonia, of Captain Herbert Gregory, for many years a member of the staff of the British Insulated and Helsby Cables Co., Ltd., and secretary of the Electric Supply Co., of Victoria, Ltd. He served in France with the Machine Gun Corps, and on being demobilised was appointed secretary of the Electric Supply Co. of Victoria, Ltd.

NEW COMPANIES REGISTERED.

Midland Arc Electric Welding Co., Ltd. (160,429).—Private company. Registered November 8th. Capital, £10,000 in £1 shares. Objects: To take over the business of electric welders and boiler repairers carried on by L. Falconer and P. H. Rich at Mansfield, Notts, as "The Midland Arc Welding Co." The subscribers (each with one share) are: P. H. Rich, Buckingham Road, Woodthorpe, Nottingham, engineer; J. Falconer, 10, King Edward Avenue, Mansfield, engineer. The first directors are: H. H. Bradfield, 3, Chestnut Grove, Nottingham; J. Falconer, P. H. Rich, and R. W. Smith, Westholme, Hessle, Hull. The said R. W. Smith is permanent subject to holding 1,000 shares. Qualification, 100 shares. Secretary: W. G. Milton. Registered office: Bishops Chambers, West Gate, Mansfield, Notts.

Guppy & Lloyd, Ltd. (160,508).—Private company. Registered November 12th. Capital, £1,000 in £1 shares. Objects: To carry on the business of electrical, mechanical, and general engineers, &c. The subscribers (each with one share are): C. Guppy, 43, Vernon Street, Leigh, electrical engineer; G. E. Lloyd, 9, Buck Street, Leigh, Lancs., electrical engineer. The first directors are: C. Guppy and G. E. Lloyd. Secretary: C. Guppy. Solicitor: C. Crowther.

Ampere Electrical Engineering and Plating Co., Ltd. (160,499).—Private company. Registered November 12th. Capital, £3,000 in £1 shares. Objects: To take over the business of electrical engineers and cycle agents carried on by S. E. Cultham and A. T. L. Steedham at 21, Victoria Terrace, South Shields, as the Empire Electrical Engineers. The subscribers (each with one share) are: S. E. Cultham, 21, Victoria Terrace, South Shields, electrical engineer; A. T. Steedham, 34, Robinson Street, South Shields, electrician. The first directors are: S. E. Cultham and A. T. L. Steedham (both permanent). Qualification, £500. Registered office: 21, Victoria Terrace, South Shields.

Primary Electrical Engineering Co., Ltd. (160,531).—Private company. Registered November 12th. Capital, £1,000 in £1 shares. To carry on business as indicated by the title. The subscribers (each with one share) are: W. Baxter, 115, Limeside Road, Hollinwood, electrical engineer; J. Hill, 46, Beeston Street, Harpurhey, Manchester, engineer; W. Ogden, 11, Victor Street, Hollinwood, engineer; J. Smith, Ash Grove, Hollinwood, mining engineer; J. Taylor, 19, Collin Croft, Hollinwood, coal merchant. The first directors are: W. Baxter, J. Hill, W. Ogden, J. Smith, and J. Taylor. Qualification, £100. Registered office: Victoria Mill, off Hollins Road, Hollinwood, Oldham.

Lancashire Ordnance Accessories Co., Ltd. (160,425).—Registered November 8th. Capital, £200,000 in £1 shares. To acquire certain lands and buildings at Heaton Norris formerly occupied by the Lancashire Dynamo & Motor Co., Ltd., in the name of the Lancashire Ordnance and Accessories Co., and certain machinery and stock-in-trade therein, and also the rights of working certain patents relating to improvements in roller bearings, to carry on the business of manufacturers of and dealers in patent roller bearings, stampings, motor-car and general engineering components, shells, cartridges, guns, rifles, tanks, armoured cars, munitions, &c.; and to enter into agreements (1) with the Lancashire Dynamo & Motor Co., Ltd., (2) with the Chain Roller Bearing Co., Ltd., and (3) with J. R. Garner, securing his services as managing director. Minimum cash subscription, 20 per cent. of the shares offered to the public. The first directors are:—N. Kilvert, H. V. Kilvert, A. Tongue, J. C. Hoyle, W. Hopwood, G. L. Hardcastle, and J. R. Garner. Qualification, £2,000. Remuneration, £100 each per annum, free of income-tax. Registered office: Georges Road, Heaton Norris, near Manchester.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

W. R. Sykes Interlocking Signal Co., Ltd. (93,078).—Capital, £50,000 in 37,500 "A" and 12,500 "B" shares of 10s. each. Return dated October 8th, 1919. 42,297 "A" and 12,500 "B" shares taken up. 3s. 9d. per share paid in cash and 6s. per share considered as paid on the "A"; 10s. per share credited as paid on the "B." Mortgages and charges: £12,721.

White, Jacoby & Co., Ltd. (52,494).—Capital, £4,000 in £1 shares. Return dated September 15th, 1919. All shares taken up. £1,643 paid; £2,357 considered as paid. Mortgages and charges: £1,200.

CITY NOTES.

Marconi's Wireless Telegraph Co., Ltd. Mr. Godfrey Isaacs, presiding at the extraordinary general meeting, held on November 13th, moved the increase of the capital to £3,000,000 by the creation of 1,500,000 additional ordinary shares. He said that since the meeting in August arrangements of great magnitude and importance had been made, for which considerable additional capital would be required. Their commitments on business and agreements already entered into in the East were very considerable, these alone requiring in the neighbourhood of one million sterling, and the arrangements entered into in respect of developments in South America would call for another million sterling. There were many more matters entailing the provision of smaller sums, which in the aggregate represented a much bigger total. Other business was under negotiation. The war had brought home to every Government and to all peoples the great necessity of wireless telegraph services for all purposes. France had lost no time in making provision for a chain of stations which would enable her to have thorough communication with all her colonies, no matter how far distant, and with all other parts of the world. A number of stations were being erected by her both in Europe and abroad for these purposes. The French company, in which they were substantially interested, were engaged in constructing these stations, and by reason of their close association they were able to give the benefit, not only of their own latest inventions and patents, but also of all those belonging to this company. Italy, Spain, Portugal, Belgium, Holland, Denmark, Sweden, and the new Balkan Republics were all considering or negotiating for the erection of long-distance independent wireless communication, and stations of the latest type would be erected in each of these countries. In North America a number of high-power stations had been erected and a large number of additional stations were about to be built by the new American Radio Corporation. In South America they were building stations and there was considerable further work in prospect. The East he had already mentioned, but in addition to the commitments to which he had referred, negotiations had recently been opened for additional work of considerable importance. The time was perhaps not far distant when much of their attention must be turned to Russia. So far as this country was concerned, and its Dominions and Dependencies across the seas, as far as he knew beyond the announcement which had already been made by His Majesty's Postmaster-General as to the stations in England and Egypt, no decision had been taken. He had thought that ere this there might have been a defined policy and that the large sum of money which had been paid to this company in damages and which he proposed not to touch, would have been turned to good account for the nation. This money could have been so usefully expended in helping towards the provision of better telegraphic communication with the Dominions and Possessions beyond the seas. Every one of us had been urged to do his utmost to develop the trade of the country. But we were dependent upon quick communication to hold our own in the world's commercial competition. Yet what was the position to-day? We all found ourselves hampered in our business negotiations thruogh the terrible delays in communicating abroad. To obtain a telegraphic reply from the East, one must wait two or three weeks. And even with the Continent it was almost useless to send telegrams, for invariably they arrived after the confirmatory letter. It was true a six-hour wireless service was being conducted by the Post Office with Holland and Denmark, but either the traffic was such that the time allotted for the service was insufficient, or the stations which were being used for the purpose were of an old type and built for other purposes, for there had been no noticeable improvement in the expedition of the telegraph services. As regards the Imperial chain of stations something, he believed, was being done in continuing the construction of the English and Egyptian stations, but he could not believe that the installation of an obsolete system would be persisted in. He felt confident that we should not much longer lag behind. We must have an improved telephone service as we must have the best possible wireless service. This country would soon wake up to the necessities of the times and eventually would demand, and the Government would recognise that it required, the latest and best possible wireless chain of stations. When that day came, and it might be very soon, they proposed to be ready. Another field of development which would call for very considerable resources was wireless telephony. Considerable progress had been made and a great future lay before it. It was already assuming a practical commercial shape and gave promise of an immediate extension to their business throughout the world. After very full and careful consideration they were of opinion that considerable capital would be required in order that the company should continue its progress, and have the means of turning to full advantage the opportunities of commercial business. The speaker went on to refer to the sale of their interest in the American company. In replying to questions, he stated that he would at a later date submit a proposal for converting the preference shares into ordinary shares.

Newcastle-on-Tyne Electric Supply Co.—Shareholders were notified on Saturday, the 15th inst., that an extraordinary meeting of the company would be held on the 24th inst. to consider a resolution for the creation of additional capital. A new issue is necessary in order to provide funds to meet expenditure on the developments of the company now in hand. It is considered that the interests of the company will best be served by the creation and issue of 1,500,000 7 per cent. cumulative preference shares of £1 each, ranking as to dividend and capital in priority to the existing preference and ordinary shares. The issue is required to meet the company's existing commitments mainly incurred in 1917 and 1918, in respect of generating plant and mains extensions, which, while much delayed by war conditions, are now nearing completion. It is fully expected that by the end of June, 1920, two-thirds of these extensions will be completed, and the whole before the end of that year. It is estimated that owing to its economy in coal consumption, this plant will, even on the basis of the present year's reduced output and of the present cost of coal, save at least £60,000 in working expenses during the year 1920, and over £100,000 if the new plant were working for the full year. The estimated saving of £60,000, together with the saving of interest on bank loans, which would be repaid, will of themselves represent in the year 1920 approximately four-fifths of the amount required to meet the dividend on the proposed issue. In addition to the horse-power already connected, further demands amounting to over 86,000 H.P. have been made upon the company and its associated companies. Having regard to these large demands and the greater economy in operation, the directors have every confidence that, after the present difficult period is passed, and upon the return of more stable conditions, the business and revenue of the company will largely increase, with consequent advantages to the existing participating preference and ordinary shareholders. To make provision for future requirements, the directors intend also to ask the shareholders to authorise the increase of the existing 5 per cent. preference and ordinary share capital by £1,000,000 each.

Montreal Tramways Co.—The report states that from February 10th, 1918, to June 30th, 1919, the revenue has not been sufficient to meet the requirements under the new contract, the shortage being $1,364,112, of which $692,694 is payable to the City of Montreal when received. The gross income from all sources for the year amounted to $2,303,784 and the expenses to $1,800,537, leaving a balance carried to the credit of the general surplus account of $503,246, which added to $536,572 at the credit of this account last year, after sundry deductions, makes a total of $1,039,818. The directors have authorised an issue of $4,000,000 of five per cent. debenture stock, to be disposed of from time to time as required. Of this amount $1,000,000 was sold during the year. The increase in the rates of fares during the past year did not provide sufficient revenue to meet the whole of the company's interest allowances, and in consequence the regular quarterly dividends on the common stock for the year were deferred. A Board of Conciliation (as provided under the Industrial Disputes Act, 1907), after consideration, authorised a general increase in wages to all employés, effective from July 1st, 1919, amounting approximately to $1,100,000. The Tramways Commission rendered their decision on August 29th last, granting a further increase in the rates of fares, which decision has been appealed from to the Quebec Public Utilities Commission by the City of Montreal and some of the other municipalities, and this company.

Blackpool, St. Annes & Lytham Tramways Co., Ltd.—A circular issued to debenture-holders states that a provisional purchase agreement has been reached with St. Annes Urban Council for £135,000. This will enable the trustees to pay off debenture holders at par, but they will be unable to pay arrears of debenture interest amounting to 30 per cent. They recommend debenture holders to accept the offer. Although no interest has been paid to shareholders, they recommend the distribution of £10,000 among the preference and ordinary shareholders in the proportion of 2s. for each preference share (£1, less 2s. written off) and 1s. on each ordinary share (£1, less 4s. written off). The trustees recommend this distribution "principally on account of the fact that, though they are in possession of the undertaking, they cannot sell without the consent of the company." Another recommendation is to distribute £5,000 among the directors, managers, receivers and other officers.

Nairobi Electric Power & Lighting Co., Ltd.—Of the new issue of £1 shares, 4,840 shares were allotted on November 12th increasing the issued share capital to £39,000. The issue was over-applied for by the shareholders.

New Issue.—According to the *Financial Times* the directors of the Pernambuco Tramways and Power Co., Ltd., offer the proprietors of the company an issue of £200,000 eight per cent. 10-year notes at par.

Canadian General Electric Co., Ltd.—Dividend of 2 per cent. for the three months ending December.

Chloride Electric Storage Co., Ltd.—Dividend of 5 per cent. (actual), free of tax, on the ordinary shares.

Stock Exchange Notice.—The Committee has ordered the undermentioned to be officially quoted:—

Torquay Tramways Co., Ltd.—120,000 ordinary shares of £1 each, fully paid (Nos. 1 to 120,000).

Electro-Bleach & By-Products, Ltd.—Mr. H. J. Mackinder, M.P., presided at the meeting held last Friday at Manchester, when the proposal for increasing the capital from £180,000 to £480,000 (in 320,000 preference shares of £1 each and 320,000 ordinary shares of 10s. each) was passed. The Chairman, in explaining the scheme, said that if it was approved it would crown and complete the policy which they had been pursuing through fair weather and foul during the last six years. He said that not until the spring and summer of the present year were they able to realise that efficiency in their works that they had always intended and planned to have. The money that would result from the issue would be used as to £35,890 to repay the sum due to the Government in connection with works extensions carried out to effect increased output for the Ministry of Munitions. In regard to the redemption of the whole of the outstanding debentures they wished to lift the company to the top tier of manufacturing companies, and there was every prospect of their not being losers at all by the substitution of capital for debentures. Subject to shareholders' approval they had been able to sell to an issuing house the whole of the proposed new issue on favourable terms—the preference for 20s. and the ordinary shares for 17s., in each case ex the interim dividend. The share and debenture holders were to have a preferential right to take shares at those prices if they applied by a given date. A fuller report of the meeting appears in our advertisement pages to-day. Interim dividend on the ordinary shares at the rate of 12½ per cent. per annum, less tax, for the first half of 1919.

Prospectuses.—*The Greengate & Irwell Rubber Co., Ltd.*—The list was to close on Monday last in an issue of 250,000 cumulative preference shares (7½ per cent.) of £1 each at par. The company (as announced in our "New Companies Registered" last week) has been formed to acquire, amalgamate and develop the businesses of I. Frankenburg & Sons, Ltd., and the Irwell and Eastern Rubber Co., Ltd., both of Salford and London. The purchase consideration payable to the Frankenburg company is £481,420, as to £166,617 in cash and the rest in shares; £65,974 of the purchase price is in respect of goodwill. The purchase consideration payable to the Irwell company is £206,547, as to £56,350 in cash and the rest in shares; £54,756 of the purchase consideration is in respect of goodwill.

Lancashire Ordnance Accessories Co., Ltd.—This company has been offering for subscription 88,000 ordinary shares of £1 each at par. The list was to close on Wednesday. The company has been formed to acquire from the Lancashire Dynamo and Motor Co., Ltd. (three of whose directors are on the board), the Heaton Norris Works of the company, and to carry on the business of manufacturers of patent roller bearings, stampings, and motor-car components, &c.

London Electric Wire Co. & Smiths, Ltd.—It is proposed (according to the *Financial Times*) to convert the existing five per cent. preference shares into seven and a-half per cent. cumulative preference shares, to subdivide each of the existing ordinary and preference shares of £5 each into five shares of £1 each, and to increase the capital to £1,250,000 by the creation of 430,000 preference and 50,000 ordinary shares of £1 each. It is proposed to offer 350,000 preference shares for public subscription at par. The matter has been before a shareholders' meeting this week.

Anglo-Argentine Tramways Co., Ltd.—With reference to certain rumours regarding the likelihood of arrears of first preference dividend being paid at an early date, the London manager states that the prospects of the company are dependent upon a revision of tariffs which has not yet been authorised by the authorities, and no question of payment of arrears of dividend is, or can be, under consideration at present.

Electric Construction Co., Ltd.—Interim dividends at the rate of 7 per cent. per annum on the preference shares, and at the rate of 6 per cent. per annum on the ordinary shares, both less tax.

Richardsons, Westgarth & Co., Ltd.—A dividend of 12 per cent., less tax, on the preference shares for two years ended April, 1914, is announced.

Armstrong, Whitworth & Co., Ltd.—A scheme has been advanced for increasing the capital to £11,012,500 by the creation of 1,500,000 new ordinary £1 shares.

Adelaide Electric Supply Co., Ltd.—Final dividend of 7 per cent. on the ordinary shares, free of British income-tax, making 12 per cent. free, for the year.

Melbourne Electric Supply Co., Ltd.—Final dividend of 5 per cent. on the consolidated ordinary stock, free of British income-tax, making 10 per cent. free, for the year.

Indian Electric Supply & Traction Co., Ltd.—Interim dividend of 3 per cent. on the ordinary shares.

Mirrlees, Bickerton & Day, Ltd.—A dividend of 5 per cent. on the ordinary shares is announced.

British Ever-Ready Co., Ltd.—Interim dividend of 7½ per cent. on the ordinary shares.

STOCKS AND SHARES.

Tuesday Evening.

There is no doubt as to the commotion in the money market having placed a salutary brake upon speculation and the speculative fever. Business in the Stock Exchange is nothing like as brisk as it was even a fortnight ago. Although the Bank Rate was not raised last week, the mere fact of rumour having toyed with an increase is quite sufficient to make this consideration uncomfortably present as each Thursday comes nearer. Stock Exchange betting is about equally divided on the point of a 7 per cent. Bank Rate this year. Even with the present minimum, the charge of 6½ per cent. for loan money is still enough to call a halt to exuberant enterprise, and it has also had the effect of postponing some of the new issues which were on the point of being offered to the public. Markets hardened up to some extent on Tuesday afternoon, and business began to return to the speculative areas where the fall had been pronounced.

We hear that the recent issue of Edison-Swan shares was over-subscribed something like four times. The shares were strongly supported by those intimately acquainted with the company, and in the Stock Exchange it is quite expected that there will be a rise from the issue price of 21s. 6d. to 30s. in the comparatively near future. This, of course, is purely market opinion, but those who express it declare that they have every reason for their confidence. The allotments were expected to be out about the middle of this week. Siemens have been adversely affected by the long-expected announcement as to an arrangement with the English Electric Co. In some quarters a trace of disappointment is felt at the details, because the hope had certainly been raised that the English Electric Co. would buy out Siemens lock, stock and barrel, at a price considerably higher than the price of 29s., at which they have recently been standing in the market. The present level of 28s. 3d. offers the tempting yield of 7 1-16 per cent., free of tax. It is stated that Siemens and the English Electric have obtained an important contract in connection with further electrification on the North-Eastern Railway.

Dividends are already being discussed in the electricity supply market. There appears to be a pretty general idea that the rates will be much the same as those of the corresponding period last year. Citys, however, are expected to pay more, and gossip says that the company is doing exceedingly well at the present time. It is, in this connection, worth noticing the steady rise in the price lately. Although the market was cheered by the recent announcement that, in the Government scheme, part of a company's undertaking could not be acquired without the rest, uncertainty still surrounds the main question, namely, the price at which the companies will be taken over. It is, perhaps, almost superfluous to refer to the opposition that was raised to the idea of the Government's acquisition of the companies on the basis of the money laid out by the companies before the war, when materials, and everything else, were at prices very different from those ruling to-day. A large customer of one of the West-End companies rang up the office the other day and asked if he was still rationed for light, and the reply was to the effect that rationing was still in force, but that the Government Department connected with it was in such a muddle that customers were taking little notice of the scheme. Moreover, it was added that before long some of the companies, at any rate, were expecting to be allowed to increase their customers' allowance of current, having regard to the more cheerful conditions making themselves felt in reference to the output of coal.

Brazilian stocks and shares are feeling the good effect produced by the rise in the milreis. This lately has been mounting at a rapid rate, and companies like the Brazilian Traction, for instance, cannot escape feeling the difference that the rise will make to their profits. Tractions, however, are a rather bad example, because, although the price is merely steady at 60, there is not much doing in the shares. The preferred stand at 92. Rio Tramway bonds have advanced 3 to 89½ for the firsts and 76¼ the seconds, while San Paulo firsts are better at 92 and the 5 per cent. perpetual consolidated debenture stock hardened a trifle in sympathy to 78. The strength of the Anglo-Argentine group is pretty well maintained on the idea, quoted here last week, that the company may be able to pay off arrears of dividend on the first preference before long. Some indeed hope that this will be done in January, but these particular shares are 5s. down on the week. British Columbia preferred stock has improved a little, and investors are beginning to pay attention to the 5 per cent. preference stock. With the successful meeting of competition in Vancouver, and the extra business that the company is bound to develop owing to the return of the demobilised to the colony, the British Columbia Electric Railway should steadily return to something like its former state of prosperity.

Underwriting arrangements have been going on this week in connection with an issue of Lancashire Power and Construction 6 per cent. preference shares at par, tax free up to 6s. in the pound. Newcastle-on-Tyne preference weakened to 15s. 6d. and the ordinary to 18s. 6d. on news as to a big new issue of capital. It is proposed to create 7 per cent. prefer-

ence shares, taking precedence of the present 5 per cents. Potteries receded to 14s. 6d.

The Wireless group is dullish. The principal bull point at the meeting last week was the chairman's statement in reference to the American Marconi Company, and the shares of that undertaking consequently rose to 32s. 9d., from which, however, they reverted to 31s. 6d. before bracing up to 32s. The parent shares dropped to 5⅞ and rallied to 6, leaving them 7-16 down, there being distinct disappointment that the price of the new shares has not yet been disclosed. The board apparently had not arrived at a decision when the meeting was held. Canadians have eased off to 15s. A meeting of the American Marconi shareholders was to have been held on Thursday in this week to pass the resolutions for selling to the General Electric Co. of New York, U.S.A., the whole of the Marconi company's shareholding in the American company at an "advantageous" price, and, as already mentioned, a new corporation has been organised in America entitled the Radio Corporation of America, which proposes to purchase the assets of the American Marconi.

Nothing has happened to make Home Railway stocks better. Prices are in a dull and heavy state. Underground incomes have dipped below 90.

British Aluminiums at 1¾ are 2s. 6d. down, and the selling is said to come from Scotland. India-Rubber shares show noticeable strength, a gain of 15s. lifting the price to 18¼. General Electric preference eased off to 20s. Babcock & Wilcox hold their advance at 3¼. The rubber share market remains hard, and was not greatly affected in the general depression. The armament group is disposed to a dulness attributed by the market to lack of public interest.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1917.	Dividend 1918.	Price Nov. 18, 1919.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	8	8⅞	—	£6 19 4
Charing Cross Ordinary	4	4	8¼	—	6 8 0
do. do. 4½ Pref.	4½	4½	8	—	7 10 0
Chelsea	8	8	8	—	5 0 0
City of London	8	8	11½	—	7 0 10
do. do. 6 per cent. Pref.	6	6	9½	—	6 9 9
County of London	7	7	9½	+ ⅛	7 7 4
do do. 6 per cent. Pref.	6	6	9½	—	6 9 9
Kensington Ordinary	7	6	4½	—	6 6 4
London Electric	Nil	Nil	1½	—	
do. do. 6 per cent. Pref.	5	6	8¾	— ⅛	8 17 10
Metropolitan	4	5	8¾	—	7 8 2
do. 4½ per cent. Pref.	4½	4½	8⅞	—	7 1 2
St. James' and Pall Mall	9	10	6¾	—	8 8 4
South London	5	5	2½	—	7 8 6
South Metropolitan Pref.	7	7	1	—	7 0 0
Westminster Ordinary	9	8	5¾	—	7 2 2
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	91	+ ½	6 11 8
do. Def.	1¼	2½/8	22	—	7 11 0
Chile Telephone	8	8	6¾	— ¼	6 3 1
Cuba Sub. Ord.	7	7	10½	—	*6 13 4
Eastern Extension	8	8	16¾	+ ⅛	*4 14 10
Eastern Tel. Ord.	8	8	16⅜	—	*4 16 1
Globe Tel. and T. Ord.	7	8	16½	+ ¼	*4 17 0
do. do. Pref.	6	6	10½	—	5 17 1
Great Northern Tel.	22	22	26⅜	—	8 6 0
Indo-European	13	13	48½	—	6 13 4
Marconi	20	25	6	— 7/16	4 3 4
Oriental Telephone Ord.	15	10	2⅜	—	4 14 1
United R. Plate Tel.	8	8	7⅛	+ 1/16	*5 2 5
West India and Panama	1/3	1/3	1½	—	Nil
Western Telegraph	8	8	17	— ½	*4 14 2
Home Rails.					
Central London Ord. Assented	4	4	58½	— 1½	6 16 9
Metropolitan	1	1½	29	— 1	5 8 8
do. Districts	Nil	Nil	2½	—	Nil
Underground Electric Ordinary	Nil	Nil	2½	— ½	Nil
do. do. "A"	Nil	Nil	7/-	— 6d.	Nil
do. do. Income	4	5	89½	— 1½	*5 11 9
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4½	—	7 1 2
Anglo-Arg. Trams. First Pref.	½	Nil	⅜	— ⅛	—
do. do. 2nd Pref.	—	—	⅜	—	—
do. do. 5 Deb.	5	5	69½	—	7 4 0
Brazil Tractions	—	—	60⅜	—	—
Bombay Electric Pref.	6	6	12½	—	4 18 0
British Columbia Elec. Rly. Pfce.	5	5	58	—	8 18 6
do. do. Preferred	Nil	2½	46½	+ 1	5 7 6
do. do. Deferred	Nil	Nil	41½	—	Nil
do. do. Deb.	4½	4½	61	+ ½	6 19 4
Mexico Trams 5 per cent. Bonds	Nil	Nil	48	—	Nil
do. 6 per cent. Bonds	Nil	Nil	35	—	Nil
Mexican Light Common	Nil	Nil	25	—	Nil
do. Pref.	Nil	Nil	37½	—	Nil
do. 1st Bonds	Nil	Nil	54½	+2	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	33	—	*4 12 4
British Aluminium Ord.	10	10	1¾	— ⅛	6 3 1
British Insulated Ord.	25	12	2⅜	—	5 19 4
Callenders	25	25	88	—	7 9 3
do. 6½ Pref.	5	6½	5	—	6 10 0
Casther Kellner	25	20	28	—	7 12 8
Crompton Ord.	7	10	21/6	—	9 6 0
Edison-Swan, "A"	—	10	1-2xd	—	8 8 6
do. do. 5 per cent. Deb.	4	5	81½	—	6 2 9
Electric Construction	10	10	1½	—	8 0 0
Gen. Elec. Pref.	6	6½	21/-	+6d.	6 10 0
do. Ord.	10	10	2	—	*5 0 0
Henley	25	25	2½	—	5 11 1
do. 4½ Pref.	4½	4½	8½	—	6 4 2
India-Rubber	10	10	18½	+ ½	*5 9 7
Met.-Vickers Pref.	—	—	8	—	5 6 8
Siemens Ord.	—	10	28/3	—1/3	*7 0 7
Telegraph Con.	20	20	25	—	*4 17 0

Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Tuesday, November 18th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/5	..
a Ammoniac Sal	per ton	£80	..
a Ammonia, Muriate (large crystal)	"	£68	..
a Bisulphide of Carbon	"	..	..
a Borax	"	£39	..
a Copper Sulphate	"	£41	..
a Potash, Chlorate	per lb.	1/1	..
a " Perchlorate	"	1/8	..
a Shellac	per cwt.	£24 10	10/- inc.
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers	"	£28	..
a " Lump	"	£26	..
a Soda, Chlorate	per lb.	6d.	1d. dec.
a " Crystals	per ton	£7 10/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
g Babbitt's Metal Ingots	per ton	£88 to £221	..
c Brass (rolled metal 4" to 12" basis)	per lb.	1/1½	..
c " Tubes (solid drawn)	"	1/1½ to 1/5½	..
c " Wire, basis	"	1/2½	..
c Copper Tubes (solid drawn)	"	1/7½	..
g " Bars (best selected)	per ton	£150	£1 inc.
g " Sheet	"	£150	£1 inc.
g " Rod	"	£150	£1 inc.
d " (Electrolytic) Bars	"	£118	..
d " " Sheets	"	£156	..
d " " Wire Rods	"	£128	..
d " " H.C. Wire	per lb.	1/8½	..
f Ebonite Rod	"	3/-	..
f " Sheet	"	2/6	..
a German Silver Wire	"	2/6	..
h Gutta-percha, fine	"	10/- to 11/-	..
h India-rubber, Para fine	"	2/6	..
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
f " Wire, galv. No. 8, P.O. qual.	"	£42	..
g Lead, English Pig	"	£35 5	35/- inc.
g Mercury	per bott.	£17 5 to £17 10	..
e Mica (in original cases) small	per lb.	6d. to 4/6	..
e " " " medium	"	5/- to 10/-	..
e " " " large	"	12/6 to 25/- & up.	..
g Phosphor Bronze, plain castings	"	1/6 to 1/9	..
g " " rolled bars & rods	"	2/1 to 2/6	2d. inc.
g " " rolled strip & sheet	"	2/5 to 2/9	2d. inc.
d Silicium Bronze wire	per lb.	1/9	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	"	£283	£9 inc.
n " Wire, Nos. 1 to 18	per lb.	4/0	..
White Anti-friction Metals	per ton	£60 to £108	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Reconnecting a 50-H.P. Induction Motor for 15 H.P.—

During the war a manufacturing establishment required a 15-H.P., 220-volt, three-phase, 60-cycle, 580-R.P.M. induction motor for intermittent duty. The speed was an important factor, since the motor was to be direct-connected. The only 580-R.P.M. motor available within reasonable delivery date was a 50-H.P., 220-volt, three-phase, 60-cycle machine with wound secondary. In order to make use of this motor at the best possible efficiency for a load of 15 H.P. an investigation was made to see if it could be reconnected for a lower rating and still leave the winding in a condition to be reconnected for the higher horse-power at some future time. According to a writer in the *Electrical World* it was found that the stator winding was connected in six-parallel-star with 36 groups of three coils per group, or a total of 108 coils. The rotor was connected series-star. The problem was to find a connection so that with a line voltage of 220 the output of the motor could be decreased 70 per cent., or, in other words, a connection that would require a line voltage of 374 volts, that is, 220×1.70. A change from six-parallel-star for 220 volts to series-star would require a line voltage of 6×220=1,320 volts, or for a series-delta connection the line voltage would have to be 1320 /√3=762 volts approximately. By dividing 1,320 by 374 to find the possible series-star connection, the quotient 3.52 was obtained. This eliminated the star connection, as a 3.5 parallel is not practicable and three-parallel-star was out of the question, since it requires 440 volts, or 100 per cent. more than 220 volts, whereas a connection requiring only 70 per cent. was required. For the delta connection, 762 (the series-delta line voltage) divided by 374 gives 1.98, or 2 nearly. A two-parallel-delta connection therefore would require a line voltage of 381 volts, which is only 1.87 per cent. more than was required. This was considered satisfactory for an intermittent duty and the winding was connected two-parallel-delta. With this connection the motor developed 15 H.P. at 220 volts, 52.0 amp. per terminal at 580 R.P.M. The rotor winding was not disturbed. This connection reduced the power consumption, and under the conditions the cost of the larger motor, and reconnecting, was the cheapest way out of what seemed at first a very perplexing situation.

THE UNIVERSITY DEGREE IN ENGINEERING: A UNIFORM STANDARD NEEDED.

By "A UNIVERSITY LECTURER."

If one searched carefully enough, one would be almost sure to find among the numerous writings of Mr. H. G. Wells the statement that the main purpose of a university is to make a man think. It is certain that, if Mr. Wells believes in the very commonly expressed idea that Almighty God arranged the recent conflagration in Europe for the ultimate benefit of mankind, then also Mr. Wells believes that the real benefit that will accrue to this generation and those that will follow lies in the stimulus provided by the war for our imaginations and thinking apparatus And most of the people who have had anything to do with the training of the university undergraduate will agree with Mr. Wells that it is the essential part of the education provided—this purpose of making the student think.

Of course, we also want to accomplish something else. Bad as is the English system of education, it is better than the German system. For the fundamental difference of the two is this—the German asks of a man what does he know, and the Englishman asks what does he do. The German possibly thinks much more, but with far less originality. In that respect his system of education reminds one of that prevalent for so long in China. For the Chinese officials learnt a great deal about good maxims, and their memories enabled them to write down splendid thoughts. Only they failed to do the things which they suggested. So long as they passed the official examinations, in which great stress was laid on the ability to write essays about morality and the good conduct of life, they obtained lucrative positions; but disaster invariably followed if they tried to put these ideas into practice. It reminds the writer of some of his engineering students who spent many weary hours in the study of the higher mathematics, and who were told, when they got into practical work, that it was not safe to go outside of the covers of an engineer's pocket book for any ideas to be used in practice. That statement always checked the enthusiasm of the student.

Educating Engineers.

For 25 years the writer has been occupied, as a student and a teacher, in the details of engineering education. In most cases the courses were so arranged that the student entered the college at about the age of 16, after having matriculated. He then spent a varying period, of from three to five years, in acquiring the coveted degree or certificate, which showed—what? It is very hard to say that it showed anything more than an ability to answer certain examination questions: or perhaps it proved that the owner possessed an ability for making fairly accurate calculations. Although, in some of the courses, it was essential to do drawing office and laboratory work, it is always very hard to say how far such work done by the student results from his own thought. The instructor shows him what to do; or more often another student "gives him tips."

Let us assume, therefore, that, in general terms, the university degree only gives us evidence that the student can answer certain examination questions. In other words, it proves that he learnt about (not that he has actually done) certain things which are embraced under the general heading of engineering. What is it that he really ought to know? Remembering, of course, that he has only from three to five years in which to pass from the knowledge of the matriculation stage to that demanded by a Board of Examiners which does not want the degree to be "cheap."

As a student, the writer had a profound respect for the men who taught him the elements of engineering over that critical period of the five years between school and the serious business of earning a living. He did not realise then, as he does now, that, although they were very earnest and conscientious, yet they left untaught many things which they ought to have taught, although he cannot say that they taught anything that they ought not to have taught.

In after years, as a teacher, the writer used to wonder whether his own students were being taught the things that were essential to them for their after life. It was the old problem which other people besides engineers are now worrying about. It was the search after efficiency.

The Engineering Degree in London.

At the present time Lord Haldane does not seem to be quite as popular as he was some ten years ago, but it is only fair to remember that he did spend a great deal of his time, without any remuneration, as chairman of a Royal Commission on University Education in London, and that the chief purpose of his work was to improve the facilities in London for training applied scientists. That Commission did good work, if only because it recorded various definite ideas about the necessity of, and the facilities for, such training. It was once the privilege of the writer to discuss at length the problem of the training of engineers with Lord Haldane, and he certainly had generous ideas about the part which the State should play in any perfect scheme. Apparently the State will be much more generous in the future than in the past, because of the lesson of the war.

The London University degree in engineering, as it existed a few years ago, had its weaknesses. Particularly did it have one which the electrical professors were never tired of exposing. For a student could gain an engineering degree without passing any examination in any branch of electrical engineering. It was said that the graduate B.Sc. (Eng.) might pass through the mesh of the examinations without having to reveal any more knowledge of either a dynamo or a motor than the student in elementary physics has of such machines.

It is as well to understand that fundamental weakness of the system, because reforms are in the air, and no doubt now that the war is over there will be changes, not only in administration but in the curriculum of universities and technical colleges.

One great problem before the London University, so far as the engineering degree is concerned, is what is called the external degree. It offers a degree which is obtainable by passing examinations only. All other English Universities insist that certain definite lectures and classes should be attended by the candidate for a degree. To obtain an internal degree in London such courses must be taken at some recognised college.

Many teachers think that the most important portion of the training of an engineering student is in the laboratories and drawing offices. There has been a great tendency to devote more and more of the student's time to such work, and the advantages of doing so are real. It does seem to be doubtful policy for examiners to give a degree in engineering without being satisfied that the candidates have done a certain amount of experimental work.

The University of Birmingham insists that the engineering student shall attend for four years, unless he has done the work of the first year's course before he enters the University. Incidentally, it may be mentioned that the University of Birmingham used to provide—probably still does—excellent facilities for workshop instruction. There was not only a machine and fitting shop, but also a foundry, smiths' shop, and a pattern shop. Other universities and technical colleges might, with advantage, give similar facilities.

There are two other weaknesses in the London curriculum. The time of three years is too short; it should be made four years. And the student has too much choice concerning the subjects for examination.

A Suggested Course.

Engineering, as taught in colleges, may be divided into the three broad divisions of civil, mechanical and electrical engineering. It is possible to give all of the students a common course in the first two years.

The following is a rough scheme for the four years, which is suggested after a long experience in teaching. It was decided upon by the writer when he was called upon for advice concerning the engineering course for one of the new universities.

It was completed after careful study of the many calendars issued by technical colleges and schools.

The first year's course might contain lectures for 12 hours a week, and the rest of the time could be spent in the laboratory or drawing office. Lectures in mathematics might occupy six hours; lectures in physics, three hours; lectures in chemistry, two hours; and an introductory lecture on engineering, one hour a week. Geometrical and machine drawing classes should be held for four hours a week; the rest of the time could be equally divided between the workshops and the physics, and chemistry laboratories.

In the second year, mathematics (pure and applied) lectures might occupy six hours a week, physics (heat and electricity) three hours a week, and courses on applied mechanics (elementary strength of materials, structures, machines, and hydraulics), and heat engines three hours a week. In the physics course, electrical measurements should form an important feature of the work in lectures and laboratory. About four hours a week for each should be spent in the following work:—(*a*) Machine drawing; (*b*) applied mechanics laboratory; (*c*) physics laboratory.

In the third year, lectures of two hours a week each course should be given in electro-technology, strength of materials, theory of machines, theory of structures, and heat engines. Eight hours a week drawing-office and eight hours a week laboratory-work is necessary.

The aim of this third-year work is to ensure that, whatever particular branch of engineering the student may subsequently find himself in, he shall have a knowledge of the fundamentals of engineering.

In the fourth year the students can reasonably hope to specialise in one of the three main branches of engineering, viz., civil, mechanical, or electrical. The mechanical and electrical engineering students should take about two-thirds of the work as a common course, for it is possible to specialise still more in a post-graduate course, or by practical experience.

It is suggested that civil engineers can take, as their three fourth-year subjects (*a*) Surveying, (*b*) Advanced Structural Design, (*c*) Hydraulics, devoting about one-third of their time to each subject.

Mechanical engineers might take (*a*) Design of Engines, Boilers, &c., (*b*) Mechanical Power Generation and Transmission, (*c*) Electrical Power Generation and Transmission.

Electrical engineers might take (*a*) Design of Electrical Machinery, and (*b*) and (*c*) as mechanical engineers.

In the fourth year the student can work much more independently, and requires fewer lectures per week, and more advice as to reading.

At the end of each year it is important to hold an examination, and to insist that students who fail shall not proceed to the next year's work.

An important part of the training should be the visits to works and the meetings of the Students' Engineering Society. The writer has often tried to formulate a practical scheme that will take into account the reading of papers and the ability to discuss technical subjects at the meetings of Students' Engineering Societies, but he cannot see how it can be made to count for a degree, although it should do so.

It is often stated that a knowledge of a language other than the mother tongue is advisable. In the examinations for the London Science Degree it is essential. The only difficulty is to find space in the four years' engineering course.

Practical experience cannot be included in college work, but of course students can be encouraged to spend their vacations—which are usually lengthy—in gaining such useful experience.

All of the other professions—the legal, the medical, &c., have a recognised curriculum for the training of students, and it is essential for the status of professional men that their qualifications should be fully recognised. For that reason, and because of the existing divergence of training given in the different colleges, the suggestions to secure a uniform course have been made. In that way employers would know that any B.Sc. (Eng.) had been trained along certain lines. There would not be any confusion as to the work done by graduates from different Universities.

THE INTERNATIONAL MOTOR-CAR EXHIBITION.

(*Continued from page* 614.)

All motor show records of attendance were broken at the Olympia Exhibition which closed on the 15th inst. The number passing through the gates on the opening day was 22,685, on the second day 36,155, and on the fifth day 52,108, the total number of people passing the turnstiles reaching 285,837 in the eight days. The King and Queen, accompanied by Princess Mary, visited the show on Friday morning last week.

During the short year in which motor-car manufacturers have had to reconstruct they have been working under abnormal conditions. Few real novelties were noticeable during our brief inspection of the large number and variety of exhibits. The almost general adoption of self-starter and electric lighting outfits was a good feature; where a combined electric lighting and starting installation is fitted the provision of a separate magneto for ignition purposes would seem to be unnecessary. Out of a total of about 129 makers, who in most cases each exhibited several cars, only 10 made use of coil ignition, but not exclusively. Except in two or three cases coil ignition was used on some models and magneto ignition on others. In one case ignition was by means of alternating current generated by the flywheel and converted to H.T. by a coil. In this case a mechanical self-starter was fitted, but electric lighting was used, A.C. energy being produced in a similar manner to that for ignition. Out of the total cars inspected only some 17 cases were noted where no self-starter was fitted, and four where mechanical self-starters were used, the rest being all electrical. Lastly, only seven cases were noted where electric lighting was not used. In the component and accessory section some 91 exhibitors occupied space, of whom about 60 had electrical apparatus and fittings on view.

The Hertford Street Motor Co., Ltd., 7, Hertford Street, Mayfair, London, W. 1, with which has been amalgamated the Electromobile Co., exhibited the only electric vehicle that was on view at the show, namely, a well-made and excellently finished "Elmo" electric landaulette as shown in fig. 1. In introducing the 1920 model the firm points out that every part and accessory is constructed throughout in England and assembled at the London works. The car, which is so simply handled that any competent chauffeur can safely drive it after two or three lessons, seats six persons, and is rated at 8 to 12 H.P. The car starts and stops without jerking, it is noiseless, vapourless, and runs without vibration. It turns without reversing in narrow streets, and is most convenient for use in congested thoroughfares. After twenty years' experience the makers are able to say that the cost of upkeep and repair of the mechanical and electrical outfits of these carriages is about one-tenth of that for other types of mechanical traction vehicles—in other words, 5 per cent. depreciation per annum will probably meet the case. The frame of the chassis is straight in elevation and rectangular in plan, inswept at the front to allow for an unusually ample steering lock, and is constructed of rolled-channel steel, while the spring attachments are steel forgings riveted on. The wheel-base is 8 ft. 9 in. and the track 4 ft. 6 in. The wheels are of the normal artillery pattern, fitted with detachable rims and "Dunlop" pneumatic tires, 815 by 105. The Marles patent steering gear is embodied in the chassis. In this type of steering cams and rockers take the place of the customary worm and sector. Owing to the rolling nature of all movement connected with this, gear friction is reduced to a negligible quantity, and no measurable wear should be apparent for many years. The cams are so arranged as to give any desired gear ratio in and near fast driving, *i.e.*, straight ahead and nearly straight ahead positions, but towards the full lock on either side the ratio is considerably reduced, thus permitting any range of lock to be brought about by slightly less than one complete turn of the wheel. The controller gives six forward speeds ranging from three to twenty miles an hour, one electric brake, and one reverse speed. It is simple and compact; alternate brushes are attached to opposite rows of terminals. The frame-work of the controller is an aluminium casting bolted to the chassis with brackets. Its position is thus hori-

zontal and immediately below the floor-boards, in which is a trap-door giving access to the brushes and terminals. Ratchet mechanism is provided to prevent any lingering between the positions of contact. An index plate showing the positions for the speeds is mounted immediately behind the hand-brake handle.

The motor is of 8 B.H.P. at 1,500 R.P.M. on a continuous load, but it can safely exert over 16 H.P. for short periods. It is bi-polar and series-wound, having two separate commutators connected to separate armature windings. By the arrangement of field castings and bobbings, magnetic joints are avoided and the distortion of field due to armature reaction is counteracted, resulting in a reduction of field ampere turns and a total suppression of sparking. The field casting forms a protective shell, enabling the motor to be completely enclosed, but at the same time rapidly dismantled. Doors give full access to the commutators and brushes. Morganite carbon brushes are used, and the motor is fitted with ball bearings throughout. The motor is designed to receive the combined voltage of all the cells in the battery—*i.e.*, the entire battery is at all times in series. This eliminates the troubles arising, it is claimed, from unbalanced conditions of the battery, as when several sections are operated in parallel.

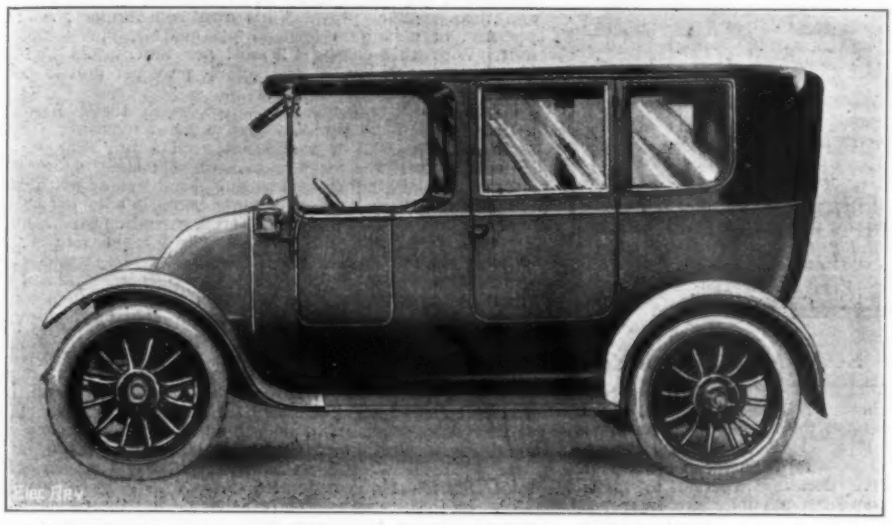


Fig. 1.—The "Elmo" Electric Landaulette.

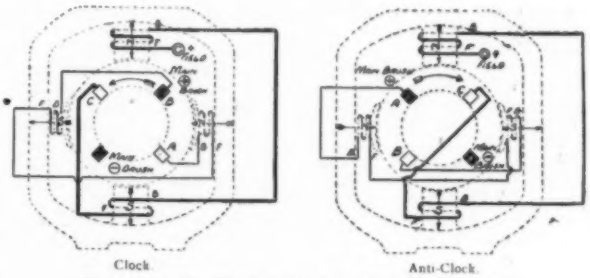
The motor drives through a double train of double helical gearing to the differential, and thence to the hubs of the rear wheels by live shafts, which revolve in an external tubular axle. This is stationary except for the slight radial movement permitted by the suspension springs carrying the motor. It consists of two tubes united by a cast steel gear-box, and extending within the road-wheel hubs, which revolve on ball bearings. Their outer ends are hexagonal, and the drive is transmitted by dogs which slip over the shafts and are bolted direct on to the road wheels. The motor casing is continued into the gear-box, so that the entire driving mechanism is dust and waterproof, and can be entirely detached from the carriage by removing the spring clips and the pins by which the motor is suspended from the frame. The gear runs in oil, which is thereby distributed automatically through the bearings.

Three brakes are fitted:—(1) A double-acting expansion brake on the hubs of the rear wheels, applied by a foot-pedal. Ample provision is made for adjustment on both brake rods and brake shoes. (2) A double-acting expansion brake in a drum mounted on an extension of the intermediate gear shaft and actuated by hand-lever. (3) An electric brake operated from the controller. On both the hand and foot brakes the electric current is broken before the brakes are applied. A quick-brake switch is connected with the foot-brake pedal and hand-lever, so that before the brakes are applied the electric circuit is broken on a pair of carbon brushes, provided with suitable adjustment and operating in a magnetic field. This in addition to reducing sparking to a minimum provides for an easy and inexpensive method of replacement.

An "Ironclad" battery is employed as standard, giving the carriage in practice a radius of fifty miles on one charge. The life of the battery is apparently quite 25,000 car miles. The car is fitted with electric lighting, a milliometer, an ampere-hour meter, and a combined volt and ammeter. An underslung battery box is used, the wooden box being braced by a steel framework terminating in a lug at each corner, which are engaged with taper pins, sliding in brackets on the chassis frame, and are operated from either side of the car by a simple screw mechanism. The body as shown was of a comfortable three-quarter landaulette type, upholstered in light hair cloth and fitted with spring mattress cushions, concealed front folding seats, and frameless windows. Prospective purchasers are given a choice of (*a*) purchasing the car fully equipped, which involves an additional outlay as well as the cost of battery-charging plant, (*b*) adopting the company's maintenance system on a yearly basis and guaranteeing a satisfactory service. The charge for this service is under two heads:—(1) A continuous charge accruing from day to day all the year round; (2) applies only to days upon which the car is used.

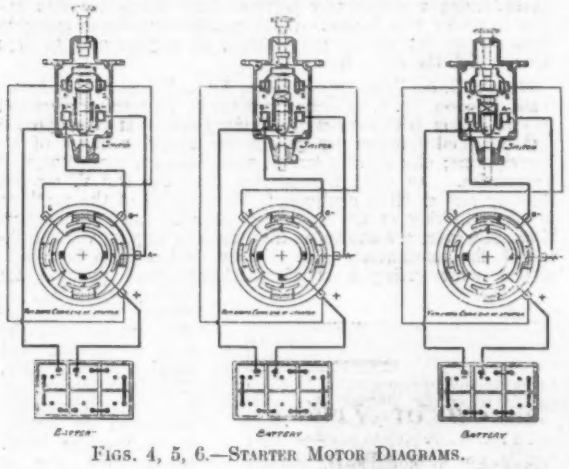
Messrs. C. A. Vandervell & Co., Ltd., Warple Way, Acton Vale, London, W. 3, exhibited practically everything electrical in connection with motoring, including electric starter, dynamo lighting, and ignition equipment for motor vehicles of all descriptions; also driving lamps, accumulators, magnetos, and accessories. In what follows regarding the C.A.V. electric lighting and starting equipment, the rotation of the machine is taken looking at the driving or spindle end; the connections, however, are shown as they actually appear when looking at the commutator end. Many devices have been employed when using a standard shunt-wound dynamo for battery charging, to ensure that the machine would give the correct output at varying speeds. Mr. Midgeley's invention, however, confines the regulation of output to the machine itself. Briefly, the idea is this: when current is passing in the working coils of the armature, the latter becomes itself an electromagnet having a flux at an angle to the main field. This flux, split into two components, gives first a flux in direct opposition to, and secondly, a flux at right angles to the main field. The latter flux is neutralised by the action of the auxiliary coils, leaving the first flux, which is dependent upon the current taken from the armature, directly opposing the main field. The current in the auxiliary windings increases with the speed of the machine, whilst that in the main field drops, the relation being so proportioned that the output at very high speeds is slightly less than maximum, thus preventing overheating. The design of the machine affords a low generating speed, enabling the driving gear ratio to be kept low. Commutation is good. Figs. 2 and 3 show the internal connections of the dynamo.

With the ordinary series-wound motor, which has rapid acceleration, gear engagement is noisy, and the full power is applied on the teeth before they are right home. Additional field windings are provided in the C.A.V. geared starter to give a weak field. The first part of the switch connects these windings, and at the same time part of the armature is short circuited. The effect of this is that the motor commences to revolve very slowly, whilst the armature also moves endwise slightly, due to the solenoid action of the field magnets. This ensures that the sliding pinion does not stick against the top of a tooth. Once entered, the continued revolution of the armature draws the pinion right home and the further movement of the switch applies full power, previously releasing the short-circuiting block. The only precaution necessary in operating this switch is to do so slowly. Diagrams 4, 5 and 6 show what takes place on switching in the starter: (1) Off position. The spring controlled contact is short circuiting that part of the armature subtended by the main brush and the slow running brush, but no current is passing. (2) The short circuit is still on, but the "slow running" coils are



Figs. 2 & 3.—Connections of C.A.V. Dynamo.

connected to the battery, giving the initial engagement of the gears, and the armature revolving slowly pulls the pinion right home before the power is applied. (3) The short circuiting block is held out of engagement by the pressure of



Figs. 4, 5, 6.—Starter Motor Diagrams.

the spring, while both the "slow running" and "power" coils are connected to the battery in series parallel. The particular diagrams illustrated are those of the "ZB" starter, clockwise rotation.

(To be continued.)

ELECTRIC POWER SUPPLY TO WORKS.

At a meeting of the Manchester Association of Engineers, held on October 25th, a discussion took place upon the prices and conditions for the supply of electrical power to works. It was opened by Dr. W. Cramp, who, from the point of view of the consumer, said that in deciding whether to install power plant or to take power from a public supply certain considerations arose which could not be expressed in terms of £ s. d.; for example, the advantage of concentrating attention upon one's own business and leaving to others the solution of the problems incidental to the generation of power. Many trades required hot water for industrial processes, and steam was used under very advantageous conditions, because the latent heat of evaporation was largely recoverable. In other industries the heat given out by the processes could be utilised for the production of power. A public supply could hardly compete effectively in these circumstances. There were many other cases where the conditions were different; in considering them Dr. Cramp grouped the factors of size, hours per week, and nature of load under the term "load factor," and defined the load factor as the Board of Trade units actually used during the time T, divided by the units that would have been used had the demand been at the maximum during the whole of the time T. As examples of load factors he gave: Flour mills, 50-80 per cent.; chemical works, 70-90 per cent.; machine tool works, 12-25 per cent.; steel works, 25-40 per cent. Almost invariably the bases of the tariff was the compound charge of which the following example was typical:—A fixed sum of £4 per annum per KW. of maximum demand plus ½d. per unit registered by meter, the price per unit to be increased or decreased 0.03d. per unit for each complete shilling rise or fall in the price of coal above the basis price of 12s. per ton. A minimum annual payment for a number of years. The price per unit was arrived at by reducing the fixed charge to pence, multiplying by 100, and dividing by 8,766 (the number of hours in a year), and dividing also by the load factor. The figure thus ascertained was the unit charge equivalent to the fixed charge. To this was added the price per unit as agreed and the increment on the coal clause. Assuming a load factor of 50 per cent., and the price of coal as 30s. per ton, the case he had cited would work out thus:—

$$(4 \times 240)/(8{,}766 \times 0{\cdot}5) + 0{\cdot}5 + (30 - 12) \times 0{\cdot}03$$
$$= 0{\cdot}22 + 0{\cdot}5 + 0{\cdot}54 = 1{\cdot}26\text{d. per unit.}$$

There were unaccountable variations in the relationship between the parts of the compound charge. For 250 KW. the fixed charge per KW. per annum was, in Rochdale £2 10s., Sheffield £4, Liverpool £6. The charge per unit also varied. In Rochdale it was 0.5d., Sheffield 0.44d., Liverpool 0.45d. The coal increment was fairly standardised, and in general amounted to 0.02d. to 0.03d. per unit for each shilling increase above the basic price.

The definition of the maximum demand also varied. Some supply authorities regarded it as the kilowatts corresponding to the rated H.P. of all the motors installed. That was obviously unfair as it disregarded the diversity factor. Other authorities used a meter which recorded the maximum over a varying period. On A.C. systems the maximum demand was sometimes taken in K.V.A., thus throwing upon the consumer the onus of a low-power factor. This was fair in principle, but not in practice, as the capital cost was not strictly proportional to the K.V.A. An allowance should be made for leading power factors, but this was generally refused. The time T, in his opinion, ought not to exceed one-quarter. Some authorities tapered the fixed charge inversely with the maximum demand. This was quite reasonable, as larger units cost less per KW., but sometimes under such a tariff it paid the consumer to lower his load factor. One corporation also reserved the right to increase the price per unit to compensate for any additional charge in the way of increased interest or an advance in wages exceeding 10 per cent. above the 1915 standard. As this clause was apparently to be enforced without notice it put the consumer hopelessly in the hands of the department. A fair minimum for the consumer to guarantee was half the expected annual consumption.

At the present price of coal the following compound charge was about the best offered when metering on the H.T. side and the consumer provided his own transformer room: £1 per KW. of maximum demand per quarter, plus 0.45d. per unit. With this charge the cost per unit would be: For load factors of 0, 100, 75, 50, 25, 12½, price per unit in pence, 0.55, 0.60, 0.67, 1.0, 1.33.

Could a private company compete with that? Assuming a load factor of 25 per cent. and a plant requiring a maximum of 1,000 KW., it would not need a full stand-by set, allowing, therefore, for two Lancashire boilers, a 1,000-KW. steam turbo-alternator, condensing plant, stand-by lighting set, engine and boiler room, figures recently obtained showed that the cost would be about £20,000, excluding land. Allowing coal at 2 lb. per unit at 35s. per ton, he got: Annual charges, £2,800; coal, £3,500; labour, £650; oil, waste, stores and repairs, £350; total, £7,300. Units generated, 2.2×10^6. Price per unit, 0.8d. That compared with the 1d. per unit. It looked as though a private plant would pay handsomely in that case.

The result was still more marked where a works could be driven from a steam engine, because the generator, motors and cable would not be required. On the other hand, in a small works requiring, say, 140 B.H.P., driven from an engine of the Garret type, the price per unit for a 25 per cent. load factor was as follows: Capital charges per annum, £375; coal, £465; labour, £250; oil, waste, stores and repairs, £150; total, £1,240. Units generated, 2.27×10^5. Price per unit, 1.3d. In that case the cost of driving from the power mains worked out at 1.18d. per unit, so that there was a small financial advantage.

When it was a question of replacing existing private plant, a decision was more difficult. If the power plant was modern, usually the public supply could not compete with it in running cost; if it was old, the cost of replacing might just turn the scale in favour of public supply.

Dr. Cramp summed up his contentions thus: A public supply could not at present compete with a private plant in a new works if (1) the load factor exceeded 25 per cent. and the M.D. exceeded 1,000 KW.; (2) the load factor exceeded 30 per cent. and the M.D. exceeded 600 KW.; (3) the load factor exceeded 50 per cent. and the M.D. exceeded 250 KW. In old works each case must be determined on its merits.

In drawing up agreements a spirit of compromise must enter into the relations between the parties. All agreements for power should include reasonable terms for lighting and the permission to use 10 per cent. of the power units for lighting was often adopted and worked well. The arbitration clause should provide for reference to the president of the I.E.E. or his nominee, and stipulate that counsel should not be employed. Coming to the more contentious clauses, it was usual to stipulate that the authority should not be liable if *force majeur*, accident, strike, or lock-out affected the supply; in his opinion, there should also be provision to compensate the consumer if the supply failed, and in most cases it would be fair to extend this to cover a lock-out. The consumer's maximum should be reduced if the works was closed for a period exceeding three months, and he should be able to terminate the agreement on paymnt of a reasonable fine, proportionate to the unexpired term of the agreement. Then he suggested power to prevent the supply authority giving undue preference to favoured consumers. The Electric Lighting Acts declared that consumers of like demand must be similarly treated, but the term "like demand" had been defined as including the amount of energy consumed, the expense of supplying it, the uniformity of demand, the time at which the energy was required; and it was almost inconceivable that two works existed which were alike in these four matters. Even if they were it would be almost impossible for the consumer to prove it, as the only records were in the hands of the supply authority. Consequently secret agreements continued to exist, perpetuating an atmosphere of distrust and annoyance. No man should attempt to secure a private advantage to the detriment of the community, and no communal authority should forget that it was a trustee for the public well-being. If this spirit prevailed secret agreements might vanish. He realised very fully the responsibility of any men who would increase the number of small private plant. Though they might be economically advanta-

geous to the individual, they could not be in the aggregate economical of fuel, and the fuel supply was a national asset, or rather a world asset; and its economic consumption was, therefore, a world's interest.

Mr. Julius Frith, dealing with the question from the point of view of the supplier, said in no other commodity did the capital charges pay so important a rôle. Roughly, if the cost of a unit was one penny, a halfpenny represented the capital costs, which must be incurred in order to be able to furnish a supply, even if no actual power was taken. This explained why it was customary to divide the charge into two portions, one covering capital expenditure and the other the cost of the coal and the running charges. The load factor was of paramount importance, and the relation between the load factors of the consumers and that of the station was not a simple one. The station stood to gain by the diversity of the individual demands. A consumer whose demand did not increase the maximum load could be supplied at a rate barely exceeding the cost of the coal and oil, and much under what appeared to be the cost price of the energy, but only in a limited sense was it true that other consumers who were charged a much higher rate helped to pay for him. If the peak-load consumers did not exist, or did not take their maximum demand at the same time the station could do with less plant, and would not have sufficient of it unemployed to justify selling cheaply to the other class. On the other hand, the more there were of consumers who filled up the hollows in the load curves the lower the price at which the company could supply the peak-load customer. The cost of an individual consumer's supply—and what he ought to pay—depended only partly on his own merits; it depended also on the relation to the demands of others. Therefore, to make the load factor the only basis would be very unfair. Then the maximum demand in any single quarter might be much less than that asked for, for which the station engineer had to make provision. For this reason the fixed charge should be based on the maximum load, not on the quarterly fluctuations. New consumers should be compelled to give some guarantee of permanence. This was most easily done by an agreement to pay interest on the capital expenditure involved for a certain period. The difference between a company and a municipality was often lost sight of. The company manager was appointed by the shareholders to earn as good a return on their money as possible, subject to statutory limitations. The prices charged should be as high as possible consistent with not imperilling the success of the venture and securing additional custom. In the municipal enterprise no profit, as such, should be earned. The plant was put down by the ratepayers for their own use, and each owner-consumer should contribute to the common funds in accordance with what his supply cost to make and deliver. If it was worked on a purely co-operative basis—and he saw no reason why it should not be—an alteration in any item of the cost of production was reflected in the price charged. Only sufficient profit should be made to provide a reserve fund to prevent too sudden fluctuation in price. In comparing private plant with the public supply, certain points in favour of the latter were apt to be overlooked, viz., greater reliability, greater ease in extending the supply of power at short notice in large or small increments, the fact that it was always available, and the better return for energy and money put into one's own business instead of into the very specialised and tricky business of power manufacture. In estimating the cost of a private plant two items were often lost sight of, the cost of management and the rent of space and buildings.

Discussion.

Mr. Watson stated that in industrial districts lighting was becoming quite a small thing in comparison with power. At Bury out of a total output of 13¼ million units per annum only the odd half million was for lighting, the remainder was for industrial power and tramway load. There was no doubt that a private plant of small size could not compete effectively with a public supply. During the past ten years practically all small consumers had been swept into the net of the public supply undertakings. Tariffs should be standardised on the compound method, and approximate more closely to one another. The simplest method was to take all the costs incurred except coal, and cover them by a standing charge per kw. The running charge should be for coal only.

Mr. Butterworth pointed out the advantages of having a private plant in addition to taking power from a public supply. It gave the manufacturer two strings to his bow.

Mr. Bedson said 25 years ago he installed plant which was running to-day successfully. Still he was a great believer in municipal undertakings. It was right that the large consumer should have an advantage in price, seeing the benefit he indirectly conferred upon the small consumers. One important fact brought into special prominence during the war was the facility with which additional supplies of power could be obtained. Moreover, capital was readily got at a comparatively low rate of interest, and could be employed for effecting improvement. Labour should be eliminated, as far as practicable, by the use of mechanical devices.

Mr. F. Walker, commenting on the tables quoted by Dr. Cramp, suggested that certain factors were omitted which were in favour of electrical driving in comparison with steam, viz., increased output and better product.

Alderman Walker said a customer who was taking electricity under circumstances specially favourable to the supply undertaking had a right to expect a special price, but it was difficult to explain the conditions to other would-be purchasers. For that reason the agreements were not made public.

MODERN STREET LIGHTING.

Much has already been written and said upon the subject of street lighting since the restrictions imposed during the war were removed. When war broke out street lighting by gas-filled tungsten lamps was still in its infancy. Since then great strides have been made in the manufacture of these lamps.

The General Electric Co., Ltd., has not been behind in its efforts to produce a lantern which embodies many new qualities essential for efficient street lighting and based upon modern practice in this sphere. It will be seen from the illustrations that the ventilating and focusing devices are unique and the general appearance of the lantern good.

The lantern is known as the "City" lantern, and is designed for use with Osram lamps (Atmos type) of any size,

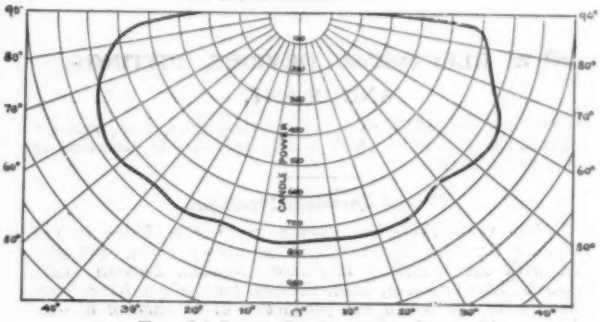


Fig. 1.—Light Distribution Curve.

from the smallest to the largest (1,500 watts) without alteration. The contours of the reflecting surfaces are such as to give the wide angle of distribution necessary for efficient street illumination, and are finished in white vitreous enamelled steel which renders cleaning easy.

Tests carried out upon the distribution of light from these lanterns, 200-volt, 500 watts, by the National Physical Laboratory are reproduced in fig. 1, giving a resultant illumination from two lanterns mounted 20 ft. above street level and 100 ft.

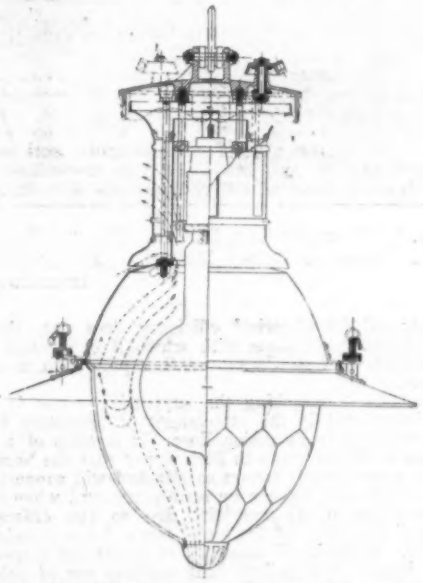


Fig. 2.—Sectional Elevation of "City" Lantern.

apart, each lantern containing one 200-volt, 500-watt lamp. To obtain this distribution of light it is essential that the filament of the lamp should be placed in the correct position relative to the reflector, and for this purpose a special form of focusing device has been designed, which enables the lamp to be adjusted quickly and without the manipulation of screws, &c. To focus the lamp it is only

necessary, after screwing it into the holder, to push it gently into the correct position, where it is firmly held by a spring rachet device. The lamp cannot work loose.

Another feature is the ventilating device, which was designed to give the maximum flow of cool air round the lamp bulb and yet maintain absolute weather-proof qualities. The device consists of two cylinders containing slots, which are arranged as shown in fig. 2. By this form of ventilation hot air is not trapped in the dome of the lanterns, but is given a free exit as it rises from the hot lamp. The resultant temperature at the neck of the bulb is found to be from 25-30 per cent. lower than is the case with the older type of ventilators. Fig. 2 gives a section of the lantern which shows the course of the air currents resulting from the use of this ventilator.

The standard "City" lantern is supplied with clear flint well glasses, unless opalescent glasses are particularly required. The globes are wired and the lip of the glass is covered with a special "U" section rubber band, which, in addition to making a water-tight joint between the glass and the lantern, guards the rim from breakage. The glass can be lowered for cleaning to the extent of two safety chains by simply loosening two milled nuts.

The lantern is made in two patterns, the first with spun-steel reflector for general use, weight 21½ lb., and the second with cast-iron reflector for use where extra weight is required, *i.e.*, for very exposed positions. The weight of this pattern is 35 lb.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Prescot Porcelain Insulators.

Of late years there has been a growing tendency to use porcelain for insulating overhead or trolley wires. Starting first with the secondary insulation, Messrs. British Insulated & Helsby Cables, Ltd., Prescot, Lancashire, have given attention to the design and production of a range of fittings which would give an all-porcelain insulated line, and they are now able to supply a range of such fittings. Attention has been given to the necessity for simplicity and ease in erection and replacement; the porcelain, vitrified throughout, is non-

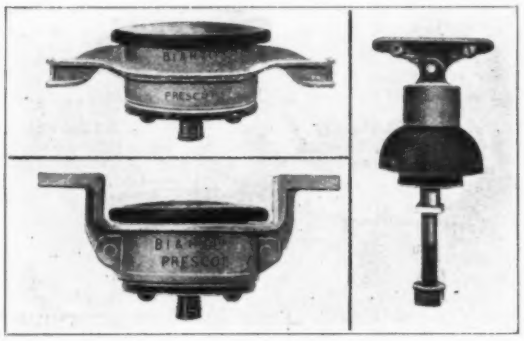


Fig. 1.—Porcelain Line Hanger. Fig. 3.—Porcelain Top-collector Insulator.
Fig. 2.—Porcelain Bridge Hanger.

absorbent, and its electrical efficiency does not, therefore, depend on the green glaze with which it is finished. The design is such that maximum weather protection is afforded to the steel screw.

The method of attaching the supporting screw is similar to that introduced in the attachment of insulators to their pins in overhead transmission lines. It consists of a special application of tarred hemp in such a way that the hemp itself forms the male thread; screws so attached will support a load of at least 5,000 lb., yet can be readily removed when desired, while breakages of the porcelain, due to the different co-efficients of expansion of the metal pin and the porcelain, are minimised. Studs in all cases are of galvanised forged steel, and the hanger and pull-off body castings are of galvanised malleable iron or bronze, the same materials being also used for the clamps of the porcelain terminating sets. The design of insulators suitable for frog pulls and lighter pull-off wires is such that they do not get out of alignment when erected. Fig 3 shows a porcelain insulator suitable for carrying a trolley wire when current is collected from the top, as in some types of traversers or cranes. Standard 10-in. H.T. disk insulators for suspending H.T. overhead lines are also made; each insulator is good for 20,000 volts working with a factor of safety of 2.25. The flash-over voltage is 45,000 when wet and the approximate weight per unit is 8 lb. 12 oz. Porcelain-insulated section insulators of the round wire and non-fouling air gap types are also made.

Mine Shaft-signalling Apparatus.

The apparatus described below has been designed, and is manufactured, at the Woolwich works of Messrs. Siemens Bros. & Co., Ltd., whose London address is Palace Place Mansions, Kensington Court, W.8. It complies with Rule 95 of the Coal Mines Act, 1913, as it provides the means to "automatically indicate in a visual manner to the winding engineman (in addition to the ordinary signal) the nature of the signal until the signal is complied with." A complete installation for signalling in shafts where winding takes place from one level only is shown in fig. 4. This equipment provides for signals which are sent from the pit bottom being received on bells both at the pit top and in the engine room. In addition, the signals are indicated visually on a dial indicator in the engine room. Signals sent from the pit bank to the engine room are received on a bell and shown visually on the dial indicator. Provision is made also for signalling from the pit bank to the pit bottom by means of the push switch at the pit bank and a bell at the pit bottom. Signals sent from either the pit bank or the pit bottom are indicated visually on separate dials in the engine room by means of a pointer which moves step by step for every stroke of the signal bell. The signals are sent by means of special sending switches, which ring the bell and register the signals on the dial indicator. Also a previous signal showing on the dial is cancelled automatically and the succeeding signal registered, thus preventing any accumulation of signals; in addition the "action" signals are cancelled by means of a switch operated when the engine starts. The foregoing describes the working of the system under the simplest conditions, but the apparatus is adaptable with equal efficiency to the more complicated con-

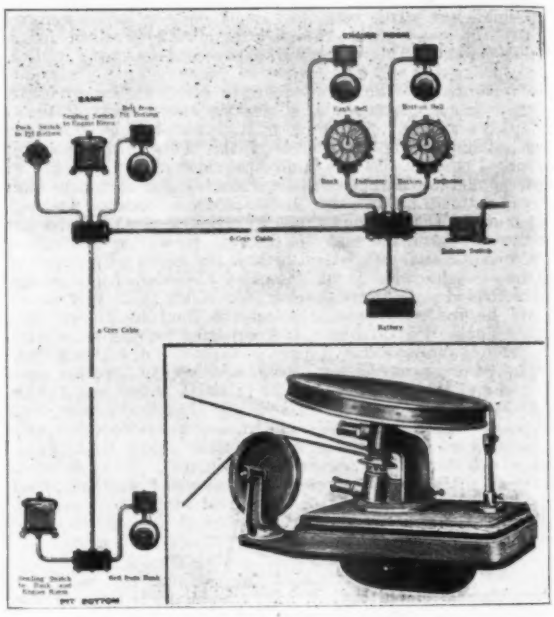


Fig. 4.—Mine Shaft-signalling Diagram.
Fig. 5.—Rotary Releasing Switch.

ditions obtaining in some collieries. It will be noted that a dial indicator is provided in the engine-room for each level in addition to one for the banksman. This arrangement commends itself by reason of the large measure of additional safety it provides, as the senders' position being clearly indicated on the dial, there arises no possibility that the engineman can mistake the origin of the signal. Should a satisfactory electric bell signalling system be already in operation, dial indicators for visually indicating the signal in the engine room can be fitted to the existing bell circuits.

Siemens's dial indicators can also be used in conjunction with mechanical signalling apparatus; the indicator is operated electrically by means of an actuating switch so mounted in the engine room that the movement of the rapper rope closes the switch, thus indicating automatically on the dial the signal transmitted. With this apparatus the sender does not cancel a preceding signal as with the electrical gear, and, therefore, should a cautionary signal be given and the engine room not move to cancel it, the action signal will cause the pointer to move further round the dial. For this reason the numerals are not marked on the dials, and, consequently, an accumulated signal will not result. To meet the desire of some colliery officials to provide an additional luminous signal indicating when "men" are riding in the shaft, an apparatus

has been designed which can be attached to any of the dial indicators, and is so arranged that, when the "men on" signal is removed from the dial for the action signal, the words "men on" are immediately illuminated on this instrument.

In the foregoing there is described a simple method of cancelling signals on the Siemens dial indicators by means of a switch which is coupled to the starting or reversing lever of the winding engine. Another form of switch, known as the "Saint" patent rotary releasing switch, is also manufactured and supplied for this purpose. This switch, fig. 5, can be applied to any type of winding engine, and is driven by means of a belt and pulley from the drum shaft. The switch acts immediately the engine is started or stopped, and by its means all orders on the visual indicators are cancelled at the slightest movement of the winding rope. It follows, therefore, that if necessary the "stop" signal can be given immediately after the engine is started, or at any time during the wind until the engine stops, when the signal is cancelled immediately.

Mazda Motor-Car Lamps.

A folder (L 134) just issued by the British Thomson-Houston Co., Ltd., 77, Upper Thames Street, E.C. 4, gives particulars of a variety of Mazda lamps for motor cars, both

Fig. 6.—Mazda Double-filament Headlight Bulb.

vacuum and half-watt types. The latter are made for 6, 8, and 12 volts, in sizes up to 48 watts. Fig. 6 shows the Mazda double-filament headlight, which gives either 1.5 or 12 c.p. at 6 to 7 volts.

A Quick "Make" and Quick "Break" Switch.

Messrs. J. H. Tucker & Co., Ltd., of King's Road, Haymills, Birmingham, have succeeded in producing a unique tumbler switch which is no larger than the ordinary flat type of tumbler switch, and possesses the new feature of a quick "make" action.

Both the "make" and the "break" are produced by a strong spiral spring which is compressed when the spindle which passes through it is in a vertical position relative to the base of the switch, so that the slightest movement of the

Fig. 7.—Tucker Quick-make and Quick-break Switch, Interior.

end of the spindle either one way or the other upsets the equilibrium, and the spring expands simultaneously, actuating a small lever which is attached to the contacts and instantaneously "makes" or "breaks" the circuit. A positive action is obtained in the initial opening and closing of the switch. Micanite insulation is used throughout, and the base is of highly vitrified porcelain. One-way and two-way switches are made, with brass or china covers. The switch movement has been experimentally operated over two million times without break-down.

Canadian Radium.—It is reported that pitchblende (radium ore) has been found in the township of Butt, in the Nipissing district of Ontario. An assay made at New York showed it to be unusually rich in uranium. This is the second occurrence of radium-bearing mineral reported to the Canadian Bureau of Mines since the Legislature offered £5,000 for the discovery of radium in commercially useful quantities.

REVIEWS.

Stress-Deflection Chart for Aluminium Strand. London: British Aluminium Co., Ltd. Price 10s. 6d.

To calculate out the essential mechanics of a transmission line, *i.e.*, sags and pulls in the conductor, with due regard for loadings (whether due to wind or ice), temperature, and the elasticity of the wire itself, is a matter involving considerable use of mathematics and time in calculation. Any method, therefore, which eliminates mathematics by use of graphics is to be welcomed.

The essence of the graphical method is the use of curves based upon the tension in a unit sectional area of conductor and the weight of a unit length of the same conductor. Such methods, of course, already exist, and one known to and made use of by the writer involves the use of stationary and moving curves (the latter being on transparent paper) to get a simultaneous value of the lengthening of the wire due to temperature and the consequent shortening of the same wire due to elasticity, or *vice versa*.

The Stress-Deflection Chart prepared by the British Aluminium Co. similarly minimises calculation by substituting the graphic method in the form of curves, and for the purpose of these curves the unit sectional area has been taken as 1 sq. in. and the unit length as 12 in. Thus the usual formula—

$$P = L^2 W / 8s,$$

where P = pull, L = span, W = weight, and s sag, is expressed as—

$$T = L^2 C / s,$$

where T = tension in lb. per square inch, C is a constant for the given material, and is equal to W/8a = 1/8th of weight in lb. of 12 cu. in. of material. Instead of having a curve on transparent paper moving over a stationary curve, the British Aluminium Co. have embodied the possible relationships of the two curves on the one chart. This makes the chart look somewhat fearsome, and it is a matter of opinion whether for office work it is better to have two charts, one moving over the other, or, as in the Aluminium Co.'s chart, all embodied in one stationary chart. For the purpose of reference on the field, obviously the complete stationary chart has its advantages.

The curves are in durable form on linen, and substantially bound.

The Motor Transport Year Book and Directory, 1919. London: Electrical Press, Ltd. Price 12s. 6d. net.

It was admitted that one of the most important contributories to the success of the Allies in the great war was the notable work performed by the motor transport. If any further demonstration of the vital importance of motor transport to the nation as a whole were needed, it has been afforded by the recent railway strike, for it is only the obvious truth to state that but for the motor transport system, alike for the conveyance of necessary food supplies, as of passengers, the position would have been extremely precarious. As it was, it was possible not only to maintain the supplies of milk and other necessaries of life by the establishment of motor convoys, but to organise road passenger services over distances which have not previously been attempted to any large extent. It is thus safe to say that if any good at all can come out of a strike, that of the railway men has set the seal on motor transport as a modern vital necessity for the community at large in a way that would perhaps otherwise have taken years to achieve. The Year Book, which has now been published annually since 1916, is a companion volume to the "Manual of Electrical Undertakings and Directory of Officials," issued by the same publishers, and is intended to provide a financial and descriptive record of British motor transport undertakings and their associated manufacturing concerns. According to the preface, information is given regarding no fewer than 303 companies, 74 municipal bodies, and 109 private firms authorised to engage in the motor transport business, the total of 486 comparing with only 350 in 1916. While this is satisfactory progress, we imagine that, judging from the large number of motor transport undertakings recently organised, the 1920 edition of the Year Book, when it comes to be published, will show even a larger proportionate development.

The contents of the book are divided into sections, the first giving a record of motor transport undertakings arranged both alphabetically as to titles and geographically as to location, there being also included a list of the railless systems of electric traction for which powers had been granted to June, 1918. Section II deals in a similar manner with manufacturing concerns, and includes an appendix giving particulars of over 60 associations and organisations connected with the motor industry. The final section of the book consists of the names and addresses of 3,000 officials connected with motor transport undertakings. We would suggest that in the next edition a chapter might advantageously be included on the subject of electrically-propelled vehicles and their suitability for use for goods and passenger transport purposes over well-defined routes. As it is, practically the only reference to the electric vehicle is in the form of the Electrical Vehicle Committee's list of stations at which the batteries of such vehicles can be charged. If this means the cutting-out of other matter we would suggest a curtailment of the references to gas traction,

which, while an excellent temporary substitute in the war days of petrol shortage and restriction, experience has shown is not likely to form a serious competitor to the more convenient liquid motor fuel. We would also suggest to the compilers that they include tables giving brief specifications of all the principal petrol and electrical vehicles on the market suitable for goods and passenger transport work, and a chapter giving the approximate running costs of vehicles of various capacities, such as are frequently published in the technical journals devoted to motor traction, and which also, as regards the cost of working of public-service vehicles, are printed in the annual reports of many of the municipal authorities running such services. By the inclusion of such information the utility of the Year Book would be greatly enhanced.

Electricity in the Service of Man, Vol. II, Sec. II, Technology of Electricity. By R. Mullineux Walmsley. Pp. viii+701, 5 diagrams and 648 figs., and index to Sections I and II. London: Cassell & Co., Ltd. Price 10s. 6d. net.

The aim of the writer of this work is evidently to give a comprehensive account of the present state of electrical engineering technology in its many aspects, without entering too deeply into the mathematical side of the subject. We may at once state that Dr. Walmsley has succeeded in this task, and has produced a work which is of value to electrical engineers and is at the same time capable of being read with advantage by those whose interest and knowledge of electrical engineering matters is of a more casual nature.

The present volume does not contain the whole of the more technical part of the complete work, continuous-current generators and motors and A.C. generators having been dealt with in the previous section. Even then a large variety of matters are included, since there are sections describing A.C. motors, electrical machine testing, transformers (both static and kinetic), secondary cells, rectifiers (of the electrochemical and thermionic types), and the transmission, transformation, and distribution of electrical energy.

All these sections are very good, and special mention may perhaps be made of the parts dealing with the rectification of currents, and with the transmission and distribution of energy, if only for the reason that they contain much material not generally available, as yet, in text-books.

In a book containing so wide a range of material it is not easy to suggest improvements or additions, but further editions might possibly be benefited by the insertion of additional matter concerning the more recent patterns of enclosed fuses, particularly of types designed to prevent the insertion of replacements of wrong calibre.

The illustrations are good, many fresh ones having been inserted in place of, or in addition to, those in the earlier editions. A large proportion of these have doubtless been supplied by various manufacturing firms, but they have been well chosen, and all are of value.

In these days it is most refreshing to come across an article in which there is absolutely no suspicion of unduly high price, and Messrs. Cassell & Co. are to be congratulated on having produced so large and excellent a book at such a low figure.

NEW PATENTS APPLIED FOR, 1919.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

26,935. "Electrical resistance and manufacture of same." G. TURNOCK. November 3rd.
26,945. "Sparking plug." R. BERESFORD. November 3rd.
26,962. "Electric cable connections for carriage lighting dynamos." C. A. MILLER. November 7th.
26,980. "Incandescent electric lights." M. C. CAUGHREAN. November 3rd.
26,984. "Terminal member and fixture stud attaching means." E. C. R. MARKS. (Toledo Metal Products.) November 3rd.
26,990. "Electrical ignition means for internal-combustion engines." G. DAVENPORT & Co. and E. C. WHITE. November 3rd.
26,991. "Ignition plugs." W. F. M. EDWARDS. November 3rd.
26,997. "Ignition systems for motor cars." C. H. G. KINGSLAND and E. W. WALSH. November 3rd.
27,006. "Thermionic and other ionic tubes." C. H. COBBOLD and G. W. N. COBBOLD. November 3rd.
27,026. "Trolley heads for electric tramcars." J. MARTIN and F. SHARP. November 3rd.
27,040. "Means for supporting antennæ used in wireless telegraphy." R. ST. GEORGE MOORE and G. S. WHITMORE. November 3rd.
27,051. "Brush holders for distributor of Ford engines." W. R. SCUTT and G. S. WHITMORE. November 4th.
27,082. "Electro-magnetic ratchet movement." W. JOICE. November 4th.
27,083. "System of distant control for electric supplies." W. JOICE. November 4th
27,085-6. "Electric bells." J. C. WRIGHTON and EDISON SWAN ELECTRIC Co. November 4th.
27,097. "Locking holder for electric lamps." S. H. COOPER. November 4th.
27,099. "High-speed electric signalling." G. W. WHITE. November 4th.
27,123. "Incandescent electric lamps." G. MALATESTA. November 4th.
27,134. "Obtaining electrical energy from the atmosphere." W. DUNN. November 4th.
27,143. "Electric power generating units." E. L. RUSSELL. November 4th.
27,150. "Machine for coating and winding electrodes." W. H. BOORNE and W. DARGE. November 4th.
27,151. "Electric resistance units." BRITISH THOMSON-HOUSTON Co. (General Electric Co.) November 4th.
27,194. "Telegraphic, &c., circuits for use with ionic tubes or valves." W. H. ECCLES. November 5th.
27,195. "Portable electric accumulators." A. E. ANGOLD and A. H. RAILING. November 5th.
27,196. "Electric heat-producing element." C. H. RODDIS. November 5th.
27,222. "Alternating current electric motors." W. E. M. AYRES and METROPOLITAN-VICKERS ELECTRIC Co. November 5th.
27,226. "Portable electric lamps." J. TWEEDIE. November 5th.
27,231. "Electric indicator." G. H. HUNTSWORTH. November 5th.
27,256. "Hygienic device for use with telephones." B. AYRE-CARR. November 5th.
27,265. "Means for fastening cover on magneto frame." SOC. DES MOTEURS SALMSON. (Systems Canton-Unne.) November 5th. (France, September 10th.)
27,314. "Vacuum tubes, &c., for wireless communication, &c." J. SCOTT-TAGGART. November 6th.
27,324. "Electric driving and controlling gear for planing machines." ELECTROMOTORS, LTD., E. GREENHALGH and B. LONGBOTTOM. November 6th.
27,340. "Electric switches." R. H. BAKER and C. W. PARSONS. November 6th.
27,342. "Electric heat pads for medical treatment." S. J. ALAVOINE. November 6th.
27,346. "Ironclad electric switches." W. L. BARBER and MIDLAND ELECTRIC MANUFACTURING Co. November 6th.
27,376. "Electric arc lamps or projectors and carbons or electrodes therefor." C. B. BURDON. (Siemens Schuckertwerke.) November 6th.
27,397. "Electric switches." BRITISH THOMSON-HOUSTON Co. and H. TRECHMAN. November 6th.
27,398. "Protective devices for electric apparatus." BRITISH THOMSON-HOUSTON Co. (General Electric Co.) November 6th.
27,404. "Electric pocket lamps." G. H. VOS. November 6th.
27,431. "Electric circuit breakers for ignition systems of internal-combustion engines." N. C. F. JENSEN and M. J. E. TILNEY. November 6th.
27,433. "Wave length or frequency indicators for wireless circuits." N. LEA and RADIO COMMUNICATION Co. November 6th.
27,440. "Apparatus for electrically locating oil bearing strata." W. R. MACDONALD. November 6th.
27,455. "Wireless telegraph systems." L. T. BARKER. November 7th.
27,456. "Electric signal recording apparatus, &c." J. B. BOLITHO. November 7th.
27,457. "Magneto electric machines." A. M. ALLEN and R. B. NORTH. November 7th.
27,462. "Electric cable connectors for carriage lighting dynamos." C. A. MILLER, F. J. MILLER and E. A. SANDERS. November 7th.
27,463. "Cable connectors for electric motor lamps." C. A. MILLER, F. J. MILLER and E. A. SANDERS. November 7th.
27,464. "Electric vehicle lamps." C. A. MILLER, F. J. MILLER and E. A. SANDERS. November 7th.
27,472. "Electric trackless tramcars." G. A. BISHOP and R. A. CHADWICK. November 7th.
27,490. "Electro-deposition of aluminium." S. CHADWICK and M. WALKER. November 7th.
27,495. "Sparking plugs." C. G. BORTHWICK. November 5th.
27,498. "Electric lamp-signalling systems." F. J. HAWKINS, H. HAWKINS, HAWKINS & SONS, and P. JOHNSON. November 7th.
27,511. "Apparatus for converting tidal energy into mechanical or electrical power." L. W. WOODHEAD. November 7th.
27,530. "Receiving arrangements for electric waves." SIEMENS & HALSKE AKT. GES. November 7th. (Germany, June 18th, 1918.)
27,597. "High-tension direct-current electrical machines." A. BOLLIGER. November 7th.
27,606. "Electrical testing apparatus." BRELLA MANUFACTURING Co. and A. T. SCOREY. November 7th.
27,608. "Automatic electric regulator." Y. GEVRIG. November 7th.
27,636-7. "Ammeters, voltmeters, &c." T. G. P. HEALEY and W. F. SMITH. November 8th.
27,678. "Miners' electric safety lamps." A. F. FORD and C. MILTON. November 8th.

PUBLISHED SPECIFICATIONS.

The numbers in parenthesis are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

7,749. MAGNETOS. H. Guillou. January 27th, 1917. (107,013.)

1918.

4,990. ELECTRIC LIGHTING OF MACHINES DRIVEN BY ELECTRIC MOTORS. V. Hope. March 21st, 1918. (133,718.)
9,601. REGULATING DEVICE FOR ELECTRIC MACHINES. O. Imray. (R. Bosch Akt. Ges.) June 11th, 1918. (133,734.)
11,045. AUTOMATIC OR SEMI-AUTOMATIC TELEPHONE EXCHANGE SYSTEMS. Western Electric Co. (Western Electric Co.) July 5th, 1918. (133,725.)
13,922. ELECTRIC TRANSFORMERS. S. Z. de Ferranti. August 27th, 1918. (133,727.)
15,136. SELF-STARTING DEVICES FOR INTERNAL-COMBUSTION ENGINES. F. L. Rapson. September 17th, 1918. (133,735.)
16,669. MEANS FOR UTILISING THE WASTE HEAT IN ELECTRICAL MACHINERY AND APPARATUS. H. F. J. Thompson and T. H. Wood. October 12th, 1918. Addition to 18,763/17. (133,748.)
16,737. ALTERNATING CURRENT MOTOR STARTERS. A. West & Co., V. Breeze and R. P. Bossom. October 14th, 1918. (133,751.)
26,749. ELECTRICAL PROCESS FOR THAWING CARCASES OF FROZEN MEAT AND THE LIKE. A. U. Alcock, W. Brander and H. J. Wagstaff. September 5th, 1918. (132,221.)
16,807. SPARKING PLUGS FOR IGNITION PURPOSES. A. E. Heath. October 15th, 1918. (133,766.)
16,842. ELECTRIC SWITCH. R. K. Dainey. October 15th, 1918. (133,768.)
16,850. APPARATUS FOR ELECTRO-MAGNETICALLY CONTROLLING JIGGING CONVEYORS. C. Candlot. May 24th, 1918. (127,229.)
17,000. ELECTRICAL DISCHARGE DEVICES. Igranic Electric Co. (Cutler Hammer Manufacturing Co.) October 17th, 1918. (133,783.)
17,122. STOPPERS FOR CLOSING THE CONTAINERS OF ELECTRICAL ACCUMULATORS. Tudor Accumulator Co. (Soc. de l'Accumulateur Tudor.) October 18th, 1918. (133,792.)
17,476. MEANS FOR GRIPPING THE FLEXIBLE CONDUCTORS OR CORDS OF ELECTRIC LAMPHOLDERS. M. J. Railing and T. Taylor. October 26th, 1918. (133,799.)
17,837. NON-SPILLABLE ELECTRIC BATTERY CELLS. S. F. Tyler and E. H. Naylor. October 31st, 1918. (133,803.)
18,069. ELECTRICAL CONTROLLER FOR THE OPERATION OF ELECTRICAL MOTORS OF THE SERIES TYPE. W. F. Stamp. November 4th, 1918. (133,806.)
18,703. ELECTRO-MAGNETIC LOCK-OUT SWITCHES. Igranic Electric Co. (Cutler Hammer Manufacturing Co.) November 14th, 1918. (133,817.)
21,467. ELECTRIC STARTERS FOR INTERNAL-COMBUSTION ENGINES. A. H. Midgeley and C. A. Vandervell & Co. December 21st, 1918. (133,845.)

1919.

3,560. ELECTRIC MERCURY SWITCHES. A. K. Toulmin-Smith. February 13th, 1919. (133,880.)
4,032. LIGHTING FIXTURES FOR WATER LEVEL GAUGES. Benjamin Electric, Ltd. August 7th, 1919. (130,359.)
4,128. ANODES FOR USE IN ELECTRO-PLATING. Schledorn. February 19th, 1919. (133,882.)
4,483. TELEPHONE INDICATORS OR ANNUNCIATORS. Sterling Telephone and Electric Co. and F. G. Bell. February 22nd, 1919. (133,885.)
4,865. ELECTRIC SWITCHES. E. A. Fägerlund. September 6th, 1918. (132,224.)
8,575. RADIO-TELEGRAPHIC TRANSMISSION SYSTEMS. W. J. Mellersh-Jackson. (A. Taylor.) April 4th, 1919. (133,901.)
15,905. ELECTRICAL REGULATING SWITCHES. C. H. Coles. June 24th, 1919. (133,924.)
22,581. ELECTRIC TRANSFORMER. S. Z. de Ferranti. August 27th, 1918. (Divided application 13,922/18.) (133,933.)